ELION

SQUARE WAVE Generator

RETURN TO
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UNIVERSITY OF WASHINGTON

COPY
2 of 6

TM 11-5134-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

SIGNAL GENERATOR SG-299/U

HEADQUARTERS, DEPARTMENT OF THE ARMY

MAY 1958

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful not to contact the –200-volt dc supply circuits or power line input connections when testing or servicing Signal Generator SG–299/U.

TECHNICAL MANUAL
No. 11-5134-15

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *14 May 1958*

SIGNAL GENERATOR SG-299/U

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Figure 1. Signal Generator SG–299/U.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual describes Signal Generator SG–299/U (fig. 1) and covers its installation, operation, and maintenance.

b. The appendix contains a list of applicable references.

c. The maintenance allocation chart will be published later.

d. The repair parts and special tools list will be published separately.

2. Forms and Records

a. Unsatisfactory Equipment Report. Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) to Commanding Officer, U. S. Army Signal Equipment Support Agency, Fort Monmouth, N. J., as prescribed in AR 700–38.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700–58.

c. Preventive Maintenance Form. Prepare DA Form 11–266 (Maintenance Check List for Signal Equipment (Test Equipment)) (figs. 6, 7, and 8), in accordance with instructions on the form.

d. Parts List Form. Forward DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manuals, 7, 8, and 9) directly to the Commanding Officer, U. S. Army Signal Equipment Support Agency, Fort Monmouth, N. J. Use this form for comments on parts listings.

e. Comments on Manual. Forward all other comments on this manual directly to Commanding Officer, U. S. Army Signal Publications Agency, Fort Monmouth, N. J.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Signal Generator SG–299/U is a wide-range (1 cps to 1 mc), square-wave generator. It is used with an oscilloscope to determine the frequency response and phase shift characteristics of video and audio amplifiers. Amplifier gain measurements may also be made with this equipment. Signal Generator SG–299/U will be referred to as a signal generator throughout this manual.

4. Technical Characteristics

X 1	1 to 10 cps.
X 10	10 to 100 cps.
X 100	100 to 1,000 cps.
X 1K	1 kc to 10 kc.
X 10K	10 kc to 100 kc.
X 100K	100 kc to 1 mc.

Types of output:	
Low impedance output	7.0 volts peak to peak. 75 ohms internal impedance. 0.02-microsecond rise time. Type BNC output connector.
High impedance output	55 volts peak to peak. 600 ohms internal impedance. 0.1-microsecond rise time. Dual banana jack output terminals.
Sync input	Positive-going signal pulse or sine wave.
Amplitude of sync input signal:	
Recommended peak	5 volts.
Recommended minimum	3 volts.
Type of input connector	BNC.
Power supply requirements:	
Line-voltage input	115 volts ac, 50 to 60 cycles.
Power consumption	210 watts.

5. Components of Signal Generator

a. Components.

Quantity	Item	Height (in.)	Depth (in.)	Width (in.)	Unit weight (lb)
1	Signal generator	13⅞	13⅞	9¾	30
2	TM 11–5134–15				
1 set	Running spares (*b* below)				

b. Running Spares. The running spares listed in the chart are packed in a separate box (fig. 2).

Quantity	Item
1	Pilot lamp, 6–8 V, DS1
5	Fuse, 2.5 ampere, 250 V, 3AG
1	Electron tube, 6BQ7
3	Electron tube, 6CL6
1	Electron tube, 6AL5
1	Electron tube, 6C4
1	Electron tube, 5U4GB
1	Electron tube, 6BH6
1	Electron tube, 6080
1	Electron tube, 5651

6. Description

a. The signal generator, which is self-contained, is housed in a portable case with a carrying handle. The power cable is permanently attached next to the fuse receptacle at the right rear corner of the signal generator. A pilot light, directly above the ON switch on the front panel, indicates when the signal generator is energized.

b. All operating controls are on the front panel (fig. 3).

c. Individual connectors, along the lower edge of the front panel (fig. 3), are provided for 75-ohm output, 600-ohm output, and the external synchronizing (sync) input connections.

7. Additional Equipment Required

a. The test applications of the signal generator require the use of other equipment. An oscilloscope is required for visual display of test results. A source of external synchronizing signal voltage, such as an audio oscillator, is necessary in certain types of operation to trigger the sync input circuit of the signal generator. Typical equipments suitable for use with the signal generator are Oscilloscope AN/USM–50 and Audio Oscillator TS–382A/U.

b. Suitable cable assemblies for interconnecting the signal generator with other equipments must be provided. The type of cable assemblies needed will vary according to the type of operation and the design of the associated equipments. Terminal connectors on the signal generator panel are the BNC type coaxial receptacles for sync input and low impedance (75 ohms) output, and banana jack binding posts for the high impedance (600 ohms) output.

CHAPTER 2

OPERATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

8. Unpacking

a. Packaging Data. An exploded view of the method of packing is shown in figure 2. The spare parts box is packed alongside the signal generator. The dimensions and contents of the shipping box are as follows:

Packing	Size (in.)	Volume (cu ft)	Weight (lb)	Contents
Oversea shipment or Domestic shipment	26 x 20 x 16¼ 20¾ x 17 x 13¾	4.89 2.87	70 42	1 Signal generator 2 TM 11–5134–15 1 Set of running spares

b. Removing Contents.

(1) Cut and fold back the metal straps.

(2) Remove the nails from the top of the box with a nail puller. Remove the top. Do not attempt to pry off the top; prying may damage the equipment.

(3) Remove the envelopes containing the manuals.

(4) Remove the outer waterproof carton.

(5) Open the outer waterproof carton and remove the inner carton that is wrapped in a moisture-vaporproof barrier.

(6) Open the moisture-vaporproof barrier and open the inner carton.

(7) Remove the running spares which are packaged in the top tray of the inner carton.

(8) Remove the equipment from the inner carton.

Note. Equipments packed for domestic shipment do not include the wooden box, outer carton, and moisture-vaporproof barrier. The manuals are packaged in the top tray of the carton with the running spares.

9. Checking Unpacked Equipment

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, refer to paragraph 2.

b. Check the equipment against the packing list. If no packing list accompanies the equipment, use the table of components (par. 5).

10. Connections

a. The signal generator is portable and requires no special installation procedures other than the selection of a suitable location close to a 115-volt alternating current (ac) power source.

b. The signal generator is shipped with all tubes and fuses installed. Check for proper seating of tubes (fig. 10) in their sockets only if the equipment proves to be inoperative. To inspect the tubes, remove the 2 screws from the rear of the case which secure the case to the chassis and the 10 screws from the edge of the panel which secure it to the case; then slide the equipment carefuly out of the case. No initial adjustments are required before operation of the signal generator.

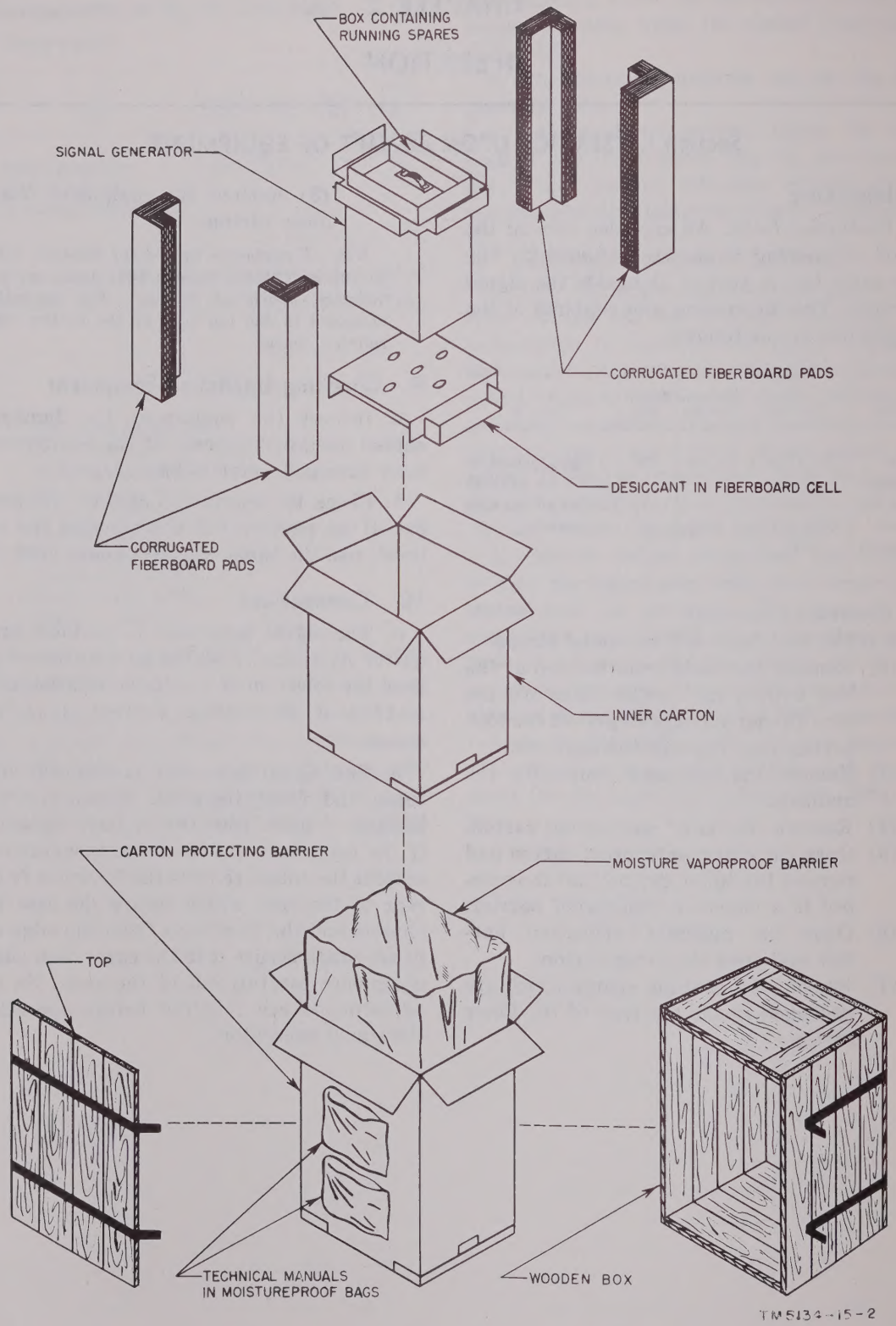

Figure 2. Signal generator, typical packaging.

Section II. OPERATING INSTRUCTIONS

11. Operating Controls and Connectors
(fig. 3)

Control or connector	Function
Power ON switch	Applies line voltage to primary of power transformer.
FREQUENCY control dial	Selects desired frequency within the frequency range determined by the RANGE switch.
RANGE selector switch	Selects the band of frequencies which can be covered by the FREQUENCY dial.
SYMMETRY control	Adjusts symmetry of the square wave output.
75 Ω ATTEN switch	Attenuates the voltage at the 75-ohm output jack in 20-db steps.
75 Ω OUTPUT AMPLITUDE control	Adjusts the voltage input to the 75 Ω ATTEN.
600 Ω OUTPUT AMPLITUDE control	Adjusts the 600-ohm output voltage.
SYNC IN connector jack	Input terminal for external sync voltage.
75 Ω output connector	Low impedance output terminal.
600 Ω output connector	High impedance output terminal.
G binding post	Ground terminal.

12. Types of Operation

a. Two types of operation are possible with the signal generator: *free running* and *synchronized.*

(1) *Free running.* The internal multivibrator operates at a frequency determined by the FREQUENCY dial and the RANGE switch.

(2) *Synchronized.* The internal multivibrator operates at a frequency determined by an external signal applied to the SYNC IN connector.

b. Two individual output voltages are provided by the signal generator—the 600-ohm and the 75-ohm outputs. Each output is available across its respective output jack. It is possible to use these outputs either individually or simultaneously, and with either type of operation described in (1) and (2) above.

c. For either type of operation, perform the following procedures:

(1) Starting procedure (par. 13).

(2) Operating procedure (par. 14).

(3) Stopping procedure (par. 15).

13. Starting Procedure

a. Connect the line cord plug to a power source of 115 volts ac at 50/60 cycles per second (cps).

b. Set the power switch to the ON position.

c. If the pilot lamp lights, the signal generator is ready for operation (par. 14).

14. Operating Procedure

a. Free Running.

(1) Set RANGE selector switch to the desired range of frequencies.

(2) Adjust the FREQUENCY dial to the desired frequency of operation.

Note. The FREQUENCY dial is divided into 10 main divisions numbered 1 through 10. These main divisions are divided into five equal subdivisions. The dial reading under the index line multiplied by the number indicated by the RANGE selector gives the frequency of operation in cycles per second.

(3) Determine whether the 600-ohm or 75-ohm output is required for the equipment to be tested. This will be governed by the nature of the tests to be made and the characteristic impedance of the equipment.

(4) Connect the signal generator to the vertical input of the oscilloscope as shown in figure 4. Either the 75-ohm output or the 600-ohm output may be used.

(5) Turn on both the signal generator and the oscilloscope and allow 5 minutes for them to warm up. Adjust the horizontal sweep of the oscilloscope for 2 or 3 cycles of output wave form.

(6) Adjust the SYMMETRY control of the signal generator for equal widths of pulses as viewed on the oscilloscope.

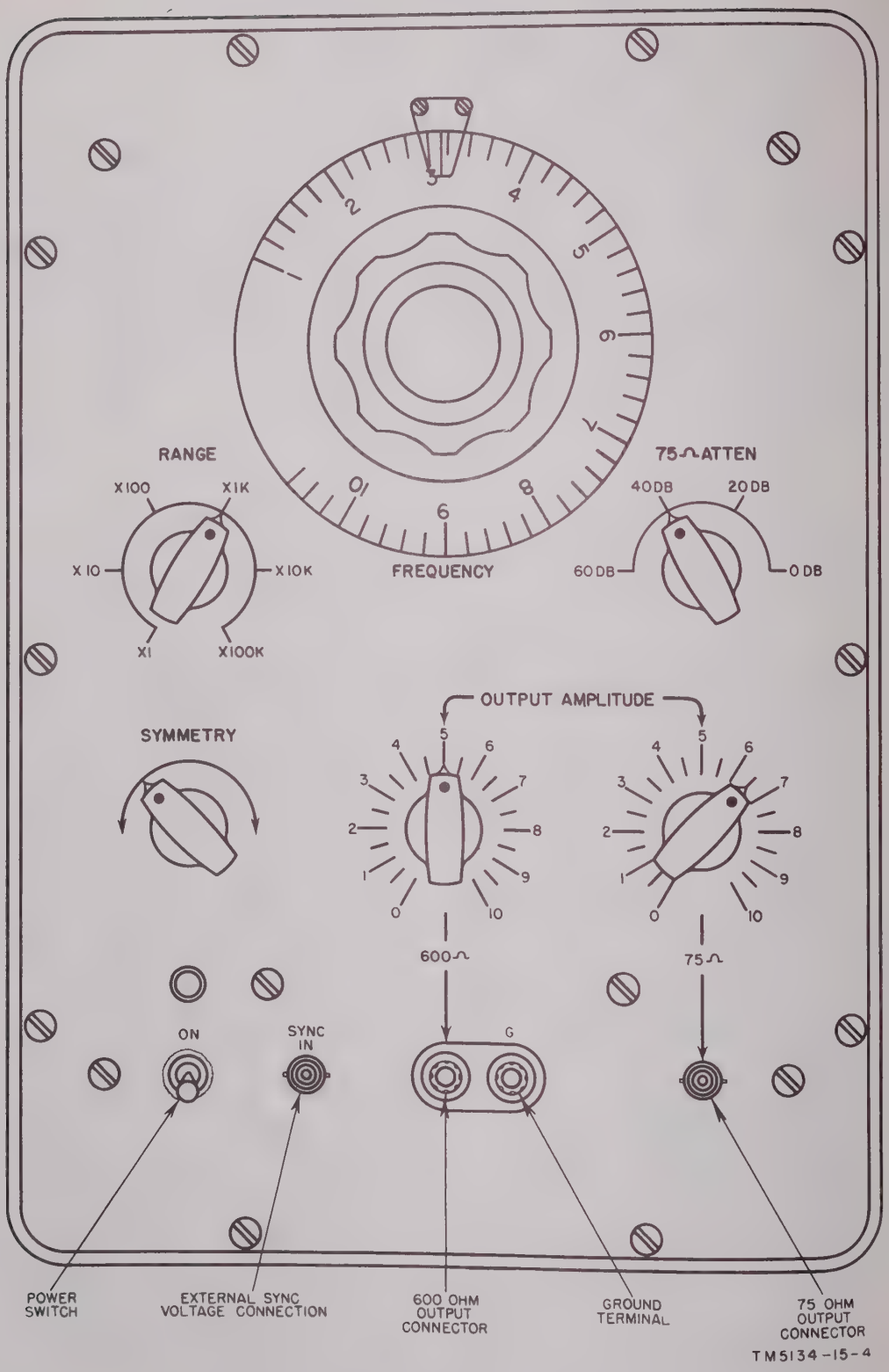

Figure 3. Signal generator, operating controls.

(7) Turn off both equipments and disconnect the output of the signal generator from the oscilloscope.

(8) Connect the signal generator to the equipment to be tested in accordance with the authorized testing instructions issued for the equipment under test and proceed as directed.

b. Externally Synchronized.

(1) Connect the desired synchronizing signal to the SYNC IN connector of the signal generator (fig. 4).

(2) Set the RANGE selector to the range which includes the frequency of the synchronizing input signal.

(3) Adjust the FREQUENCY dial to a value slightly *below* the frequency of the synchronizing input signal.

(4) Proceed in the same manner as outlined in *a* (3) through (6) above.

c. Impedance Matching.

(1) When operating into a high impedance load, such as the grid circuit of an amplifier, the output may be taken from either the 75-ohm or the 600-ohm output connector without noticeable effect on the wave shape or on the 75-ohm attenuator calibration.

(2) When operating from the 75-ohm output, into a relatively low impedance and a 75-ohm cable is used (A, fig. 5), the load impedance must be matched to the generator output impedance. To determine the value of the impedance matching network use the formula $Z_o = Z_1 Z_2$ and refer to TM 11–681, Electrical Fundamentals (Alternating Current) for further details.

(3) When the connecting cable has an impedance greater or lower than 75-ohms, the impedance of the cable must be matched to the signal generator output impedance. Typical values for matching the cable impedance to the generator are shown in B and C of figure 5.

15. Stopping Procedure

To turn the signal generator off, move the power switch down. If the signal generator is to be removed from the test bench, disconnect all test cables or leads and remove the line cord plug from the line receptacle.

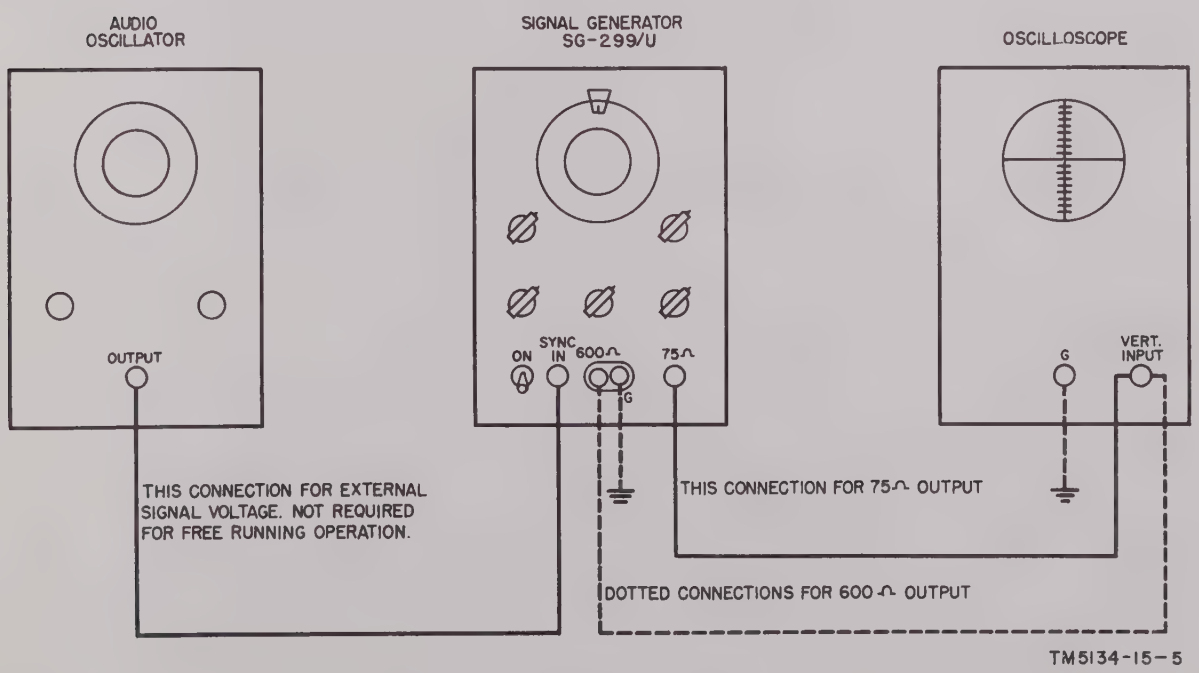

Figure 4. Signal generator, test setup.

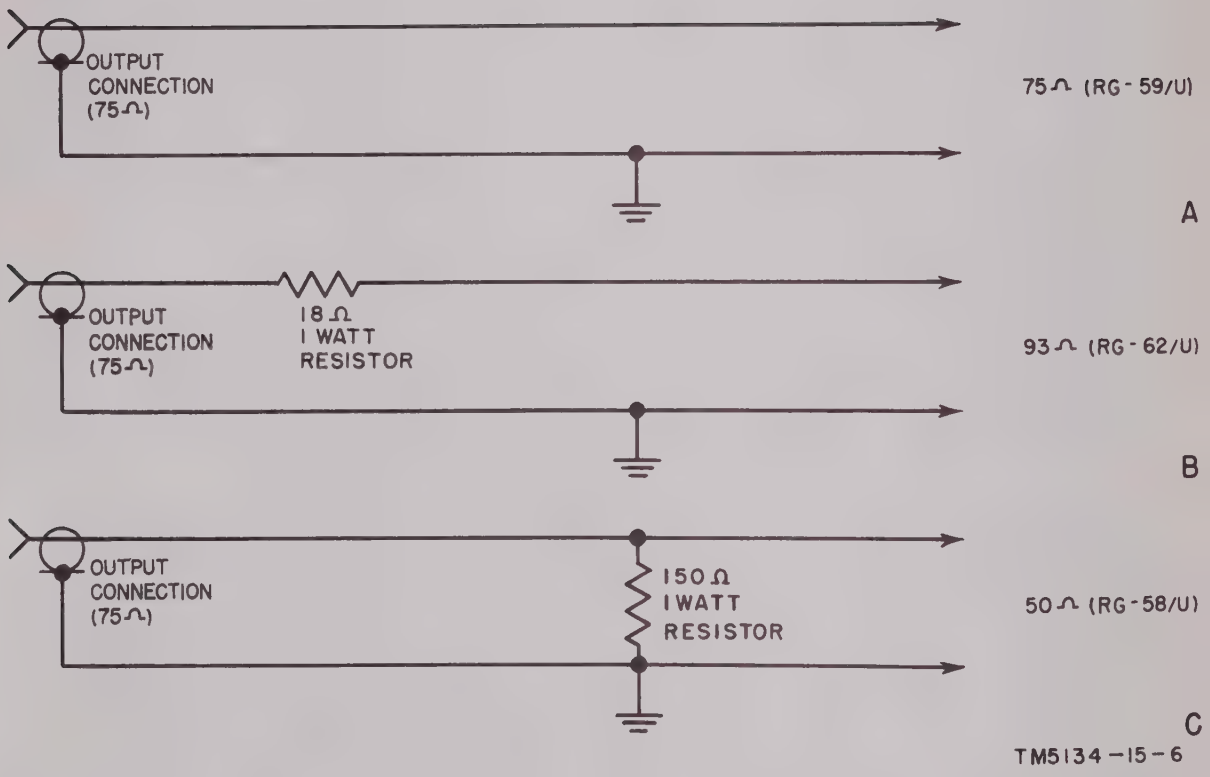

Figure 5. Typical impedance matching networks.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. OPERATOR'S MAINTENANCE

16. Scope of Operator's Maintenance

a. The following is a list of maintenance duties normally performed by the operator of the signal generator. These procedures do not require tools or test equipment.

b. Operator's maintenance for the signal generator consists of the following:

(1) Preventive maintenance (pars. 20–22).
(2) Visual inspection (par. 17).
(3) Operational checklist (par. 18).
(4) Replacement of defective pilot lamps (par. 19).
(5) Replacement of defective fuses (par. 19).
(6) Checking cable connections.

17. Visual Inspection

a. When the equipment fails to perform properly, turn off the power and check all the items listed below. *Do not check any item with the power on.*

(1) Wrong settings of switches and controls (par. 11).
(2) Power cable disconnected or poorly connected.
(3) Burned-out fuse (usually indicates some other fault).

b. If the above checks do not locate the trouble, proceed to the operational checklist (par. 18).

18. Operational Checklist

a. General. The operational checklist will help the operator recognize various types of trouble quickly. The corrective measures, to be used in case normal indications are not obtained, must generally be performed by higher echelon repair. Note on the repair tag what corrective measures were taken and how the equipment performed at the time of failure.

b. Procedure. Place the signal generator in operation (pars. 13 and 14). Connect an oscilloscope to the output of the signal generator (fig. 4). After the signal generator warms up follow the procedure in *c* below in the order given.

c. Checklist.

Check	Action	Normal indication	Corrective measures
1	Turn power switch ON	Pilot lamp lights	Check line cord plug for proper connection to line. Check fuse F1 (par. 19). Check pilot lamp (par. 19).
2	Observe output wave form from either output on oscilloscope and adjust SYMMETRY control.	Symmetrical wave form (fig. 29) should be obtained by this adjustment.	Higher echelon repair required.
3	Observe output from 600 Ω output connector. Operate the 600 Ω OUTPUT AMPLITUDE control.	Square-wave output wave form should be observed on the oscilloscope. Rotating amplitude control should vary the peak-to-peak amplitude of the output.	Higher echelon repair required.
4	Observe output from 75 Ω output connector. Operate the 75 Ω OUTPUT AMPLITUDE control and the 75 Ω ATTEN switch.	Square-wave output wave form should be observed on the oscilloscope. Switching the 75 Ω ATTEN switch should change the output amplitude in steps of 10 to 1. Rotating the amplitude control will vary the peak-to-peak amplitude on each step of the 75 Ω ATTEN switch.	Higher echelon repair required.

Check	Action	Normal indication	Corrective measures
5	Operate the RANGE switch through all positions and operate FREQUENCY dial over each range.	Output wave form should be observed for all settings of the RANGE switch and the FREQUENCY dial.	Higher echelon repair required.
6	Connect an external synchronizing signal (minimum 5-volts peak) to the SYNC IN connector. Adjust the signal generator to a frequency slightly below that of the synchronizing signal.	The output frequency of the signal generator should be the same as that of the external synchronizing generator.	Higher echelon repair required.

Note. Checks 2, 3, and 4 of the list above should be made with the signal generator set for 1,000 cycles and the sweep circuit of the oscilloscope adjusted accordingly.

19. Repairs

Except for the items listed below, all repairs and adjustments of the signal generator must be done by the organizational repairman or field and depot maintenance personnel. The following repair procedures can be performed by the operator.

a. Replacement of Fuse. The line fuse of the signal generator is on the rear of the chassis and protrudes through the back of the case (fig. 11).

(1) Press in the cap of the fuse holder and turn it counterclockwise to unlock.

(2) Pull the cap and fuse from the holder.

(3) Remove the defective fuse from the cap clip and replace it with a new one.

(4) Carefully insert the new fuse and the cap into the holder, press in the cap and turn it clockwise.

b. Replacement of Pilot Lamp.

(1) Remove the two screws behind the case that hold the chassis to the case.

(2) Remove the 10 screws on the edge of the front panel that secure it to the case.

(3) Press in the pilot lamp (fig. 24), and turn it counterclockwise to unlock.

(4) Remove the defective lamp out and replace it with a new one. Push the lamp in and twist it clockwise.

Section II. PREVENTIVE MAINTENANCE

20. Tools, Materials, and Test Equipment Required

The tools and test equipment necessary to perform organizational maintenance are authorized by appropriate publications. The following tools and test equipments are required for preventive maintenance.

a. Tools.

(1) Tool Equipment TE–113.

(2) Seven-pin and nine-pin tube pullers.

b. Materials.

(1) Cleaning Compound (Federal stock No. 7930–395–9542).

(2) Cleaning cloth.

(3) Sandpaper No. 000.

(4) Lubricating oil, general purpose (LO).

c. Test Equipment. Electron Tube Test Set TV–7.

21. General Preventive Maintenance Techniques

a. Use No. 000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning. If necessary, wipe all parts, including electrical contacts, with a cloth moistened with Cleaning Compound; then wipe the parts dry with a cloth.

Caution: Cleaning Compound is flammable and its fumes are toxic. Do not use near a flame; provide adequate ventilation.

MAINTENANCE CHECK LIST FOR SIGNAL EQUIPMENT
TEST EQUIPMENT
(AR 750-625)

EQUIPMENT NOMENCLATURE

SIGNAL GENERATOR SG-299/U

EQUIPMENT SERIAL NUMBER

21

INSTRUCTIONS

This form may be used for a period of one month by using the correct dates and weeks of the month. It is to be used as a Preventive Maintenance check list for Signal equipment in actual use, or for a check on equipment prior to issue

1. For detailed Preventive Maintenance instructions see:
   a. The Technical Manual *(in TM 11 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   b. The Supply Bulletin *(SB 11-100 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   c. The Department of the Army Lubrication Order. *(See DA Pamphlet Number 310-4)*

2. The following action will be taken by either the Communications Officer/ Chief for 1st echelon, or the Inspector for higher echelon
   a. Enter Equipment Nomenclature and Serial Number.
   b. Strike out items that do not apply to the equipment.

3. Operator/Inspector will enter in the columns entitled CONDITION, on the proper line, a notation regarding the condition, using symbols specified under LEGEND.

4. After operator completes each daily inspection he will initial over the appropriate dates under "Daily Condition for Month", then return form to his supervisor.

FOLD

TYPE OF INSPECTION

OPERATOR	2/3 ECHELON	DATE	SIGNATURE
✓		18 APR	Douglas Rodney M/Sgt.
✓		25 APR	Douglas Rodney M/Sgt.

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4

DA FORM 1 MAY 57 11-266

TM5134-15-7

Figure 6. DA Form 11–266, page 1 as used by operator.

LEGEND for marking conditions:
Satisfactory, ✓.
Adjustment, Repair or Replacement required, X.
Defect corrected, (X).

DAILY CONDITION FOR MONTH OF APRIL 1958

NO	DAILY ITEM		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	2D 3D ECHELON
			17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
1.	CLEAN DIRT AND MOISTURE FROM EXPOSED SURFACES OF ~~HOUSINGS~~, CASES, CABINETS, CONTROL PANELS, ~~INTER-CONNECTING PLUGS~~, CABLES, ~~HEADSETS, METER WINDOWS~~, ETC.	PAR. 22		DR	DR	DR	DR	DR	AC	AC	DR	DR	DR	DR	DR	AC	AC			
2.	INSPECT FOR LOOSENESS OF EXTERIOR ITEMS SUCH AS SWITCHES, KNOBS, JACKS, CONNECTORS AND PILOT LIGHTS.		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
3.	INSPECT CONTROLS FOR BINDING, SCRAPING. ~~TAP CONTROLS LIGHTLY FOR CUT OUT DUE TO LOOSE CONTACTS.~~	PAR. 22	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
4.	DURING OPERATION BE ALERT FOR ANY UNUSUAL PERFORMANCE OR CONDITION.		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			

WEEKLY	CONDITION EACH WEEK 1ST	2D	3D	4TH	5TH	2D 3D ECH
5. INSPECT CORDS, CABLES, ~~WIRE AND SHOCK MOUNTS~~ FOR BREAKS, CUTS, KINKS, DETERIORATION, STRAIN AND FRAYING. PAR. 22	✓					
6. ~~INSPECT CANVAS AND LEATHER ITEMS FOR FUNGUS, FRAYING, TEARS, BROKEN ZIPPERS AND SNAP FASTENERS.~~						
7. HAND CHECK FOR LOOSENESS ~~OF EXTERIOR ITEMS SUCH AS~~ HANDLES~~, LATCHES, HINGES~~.						
8. INSPECT FOR LUBRICATION IN ACCORDANCE WITH APPLICABLE DA LUBRICATION ORDER. PAR. 23	✓					
9 ~~INSPECT DRY BATTERIES FOR DIRT, LOOSE TERMINALS AND LEAKAGE.~~						
10. INSPECT EXPOSED METAL SURFACES FOR RUST AND CORROSION. PAR. 23	✓					
11. ~~INSPECT METERS FOR DAMAGED GLASS AND CASES.~~						

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
12. ~~INSPECT SEATING OF READILY ACCESSIBLE ITEMS OF A PLUG-OUT NATURE; CRYSTALS, FUSES, CONNECTORS, PLUG-IN COILS, LAMPS, ETC. DO NOT REMOVE, ROCK OR TWIST TO INSPECT. USE ONLY A DIRECT PRESSURE TO INSURE THE ITEM IS FULLY SEATED.~~	
13. ~~INSPECT FOR CLEANLINESS AND TIGHTNESS OF SUCH ITEMS AS SHOCK MOUNTS, ANTENNA, ANTENNA MOUNTS AND WAVE GUIDES.~~	
14. ~~INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR DIRT, CORROSION, WORN OR BURNED CONTACTS.~~	

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
15. ~~INSPECT RESISTORS, BUSHINGS, INSULATORS FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE.~~	
16. ~~INSPECT JACKS AND CONNECTORS FOR SNUG FIT AND GOOD CONTACTS.~~	
17. ~~INSPECT VARIABLE CAPACITORS FOR DIRT AND MOISTURE.~~	
18. ~~INSPECT AIR FILTERS FOR CLEANLINESS.~~	
19. ~~INSPECT SCREWTYPE TERMINALS OF TRANSFORMERS, FIXED CAPACITORS, RESISTORS, CHOKES, POTENTIOMETERS AND RHEOSTATS FOR CORROSION, DIRT AND LOOSE CONTACTS.~~	
20. ~~CLEAN AND TIGHTEN SWITCHES, BLOWERS, RELAY CASES; CLEAN INTERIOR OF CHASSIS AND CABINETS.~~	
21 ~~INSPECT GENERATORS, MOTORS AND DYNAMOTORS FOR BRUSH WEAR, SPRING TENSION, ARCING AND COMMUTATOR WEAR.~~	
22. ~~INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.~~	
23. ~~INSPECT GASKETS AND BUSHINGS FOR WEAR AND DAMAGE.~~	
24. ~~INSPECT CATHODE RAY TUBES FOR BURNED SCREEN SPOTS.~~	
25. ~~BEFORE STORING OR SHIPPING REMOVE ALL BATTERIES.~~	

IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING THE INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. *(Continue on page 4, if more space is needed)*

2 3

TM5134-15-8

Figure 7. DA Form 11-266, pages 2 and 3 as used by operator.

LEGEND for marking conditions:
Satisfactory, ✓.
Adjustment, Repair or Replacement required, X.
Defect corrected, (X).

DAILY CONDITION FOR MONTH OF APRIL 1958

NO.	DAILY ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	2D 3D ECHELON
1.	CLEAN DIRT AND MOISTURE FROM EXPOSED SURFACES OF ~~HOUSINGS~~, CASES, ~~CABINETS~~, CONTROL PANELS, ~~INTER-CONNECTING PLUGS~~, CABLES. ~~HEADSETS, METER WINDOWS, ETC.~~																																✓
2.	INSPECT FOR LOOSENESS OF EXTERIOR ITEMS SUCH AS SWITCHES, KNOBS, JACKS, CONNECTORS AND PILOT LIGHTS.																																✓
3.	INSPECT CONTROLS FOR BINDING, SCRAPING. ~~TAP CONTROLS LIGHTLY FOR CUT OUT DUE TO LOOSE CONTACTS.~~																																✓
4.	DURING OPERATION BE ALERT FOR ANY UNUSUAL PERFORMANCE OR CONDITION.																																✓

WEEKLY	CONDITION EACH WEEK 1ST	2D	3D	4TH	5TH	2D 3D ECH
5. INSPECT CORDS, CABLES, ~~WIRE AND SHOCK MOUNTS~~ FOR BREAKS, CUTS, KINKS, DETERIORATION, STRAIN AND FRAYING.						✓
6. ~~INSPECT CANVAS AND LEATHER ITEMS FOR FUNGUS, FRAYING, TEARS, BROKEN ZIPPERS AND SNAP FASTENERS.~~						
7. HAND CHECK FOR LOOSENESS ~~OF EXTERIOR ITEMS SUCH AS~~ HANDLES~~, LATCHES, HINGES~~.						✓
8. INSPECT FOR LUBRICATION IN ACCORDANCE WITH APPLICABLE DA LUBRICATION ORDER.						✓
9. ~~INSPECT DRY BATTERIES FOR DIRT, LOOSE TERMINALS AND LEAKAGE.~~						
10. INSPECT EXPOSED METAL SURFACES FOR RUST AND CORROSION.						✓
11. ~~INSPECT METERS FOR DAMAGED GLASS AND CASES.~~						

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
12. INSPECT SEATING OF READILY ACCESSIBLE ITEMS OF A PLUCK-OUT NATURE: ~~CRYSTALS~~, FUSES, CONNECTORS, ~~PLUG-IN COILS~~, LAMPS~~,~~ ETC. DO NOT REMOVE, ROCK OR TWIST TO INSPECT. USE ONLY A DIRECT PRESSURE TO INSURE THE ITEM IS FULLY SEATED.	✓
13. ~~INSPECT FOR CLEANLINESS AND TIGHTNESS OF SUCH ITEMS AS SHOCK MOUNTS, ANTENNA, ANTENNA MOUNTS AND WAVE GUIDES.~~	
14. ~~INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR DIRT, CORROSION, WORN OR BURNED CONTACTS.~~	

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
15. INSPECT RESISTORS, ~~BUSHINGS, INSULATORS~~ FOR CRACKS, ~~CHIPPING~~, BLISTERING, DISCOLORATION ~~AND MOISTURE.~~	✓
16. INSPECT JACKS AND CONNECTORS FOR SNUG FIT AND GOOD CONTACTS.	✓
17. ~~INSPECT VARIABLE CAPACITORS FOR DIRT AND MOISTURE.~~	✓
18. INSPECT AIR FILTERS FOR CLEANLINESS.	✓
19. INSPECT ~~SCREW-TYPE TERMINALS OF TRANSFORMERS~~, FIXED CAPACITORS, RESISTORS, CHOKES, POTENTIOMETERS ~~AND RHEOSTATS~~ FOR CORROSION, DIRT AND LOOSE CONTACTS.	✓
20. CLEAN AND TIGHTEN ~~SWITCHES~~, BLOWERS, ~~RELAY CASES~~; CLEAN INTERIOR OF CHASSIS AND CABINETS.	✓
21. INSPECT ~~GENERATORS~~, MOTORS ~~AND DYNAMOTORS~~ FOR BRUSH WEAR, SPRING TENSION, ARCING AND COMMUTATOR WEAR.	✓
22. ~~INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.~~	
23. ~~INSPECT GASKETS AND BUSHINGS FOR WEAR AND DAMAGE.~~	
24. ~~INSPECT CATHODE RAY TUBES FOR BURNED SCREEN SPOTS.~~	
25. ~~BEFORE STORING OR SHIPPING~~ - ~~REMOVE ALL BATTERIES.~~	

IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING THE INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. *(Continue on page 4, if more space is needed)*

2 3

TM5134-15-42

Figure 8. DA Form 11–266, as used by organizational repairman.

Item	Maintenance procedures
1	Use a clean cloth to remove dust, dirt, moisture, and grease from the front panel controls. If necessary wet the cloth with cleaning compound and then wipe the parts with a dry, clean cloth.
3	All control knobs should work smoothly, be tight on the shafts, and should not bind. Tighten all loose knobs and be sure that the knobs do not rub against the panel.
5	Repair any cuts in the power-cord insulation by covering them with rubber tape and then with friction tape. A badly damaged power cord or plug should be replaced.
10	Remove all rust from components and touch up bare spots with paint.

22. Use of Preventive Maintenance Form

DA Form 11–266 (figs. 6, 7, and 8) is a preventive maintenance check list to be used by the operator and unit repairman. Items not applicable to the signal generator are lined out in the figures. References in the ITEM blocks in the figures are to paragraphs which contain additional maintenance information about the particular item. Instructions for use appear on the form.

23. Lubrication

The ventilating and cooling fan motor (fig. 9), has oilholes in the bearing housings at each end of the shaft. One or two drops of oil (LO) applied monthly to each bearing, will provide suitable lubrication under normal operating conditions.

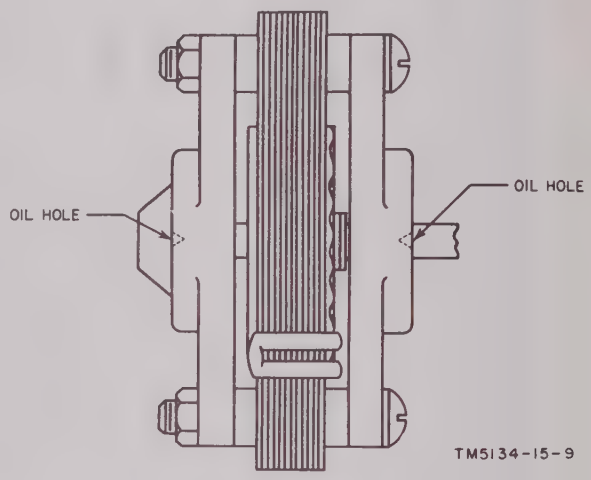


Figure 9. Lubrication of fan motor.

Section III. ORGANIZATIONAL REPAIRMAN'S MAINTENANCE

24. Scope of Organizational Repairman's Maintenance

a. General. The organizational repairman's duties are listed below. Their scope is determined by the available tools, materials, test equipment, spare parts, and the MOS of the organizational repairman. In addition to the items listed under operator's maintenance, the organizational repairman's maintenance consists of the following:

(1) Preventive maintenance (pars. 20–22).
(2) Visual inspection (pars. 17 and 25).
(3) Equipment performance checklist (par. 26).
(4) Replacement of defective tubes (par. 28).
(5) Repair of defective power cable.
(6) Lubrication of fan motor (par. 23).

b. Test Equipment.

(1) Electron Tube Test Set TV–7.
(2) Multimeter ME–77/U.[1]
(3) Oscilloscope AN/USM–50.
(4) Audio Oscillator TS–382A/U.
(5) Voltmeter TS–443/U.[2]

25. Visual Inspection

Before operating the equipment, inspect it. Inspection will often disclose the cause of trouble, save repair time, and may also avoid further damage. Inspect for the following obvious defects:

a. Broken or loose connections on the line cord plug.
b. Defective fuse.
c. Seating of tubes in sockets.
d. Loose or broken connections on printed circuit boards and tube sockets.
e. Charring of resistors.

[1]Multjmeter TS–297/U may be used until Multimeter ME–77/U becomes avajlable.
[2]Far adjustment of the −200 v dc power supply (par. 29a).

26. Troubleshooting

This troubleshooting procedure provides a method for systematically checking equipment performance. All corrective measures that the organizational repairman can perform are given in the corrective measures column. When using this procedure, start at the beginning and follow each step in sequence. If the corrective measures indicated do not fix the equipment, troubleshooting is required by higher echelon. Note on the repair tag how the equipment performed and the corrective measures that were taken. Read the supplementary information given in paragraphs 27, 28, and 29 before attempting to service the signal generator.

Step	Check	Symptom	Probable trouble	Corrective measures
1	Power supply:			
	Measure dc voltage between chassis and test point on R39 (fig. 11). Use an accurate voltmeter such as voltmeter TS–443/U.	Slight deviation from 200 volts.	Regulator circuit out of adjustment.	Adjust voltage calibration control R95 for −200-volt meter indication (par. 29*a*).
		Voltage less than 200 volts.	Defective rectifier V12 or regulator V13.	Replace tube and adjust R95 (par. 29*a*).
		Voltage greater than 200 volts.	Defective control tube V14.	Replace tube and adjust R95 (par. 29*a*).
		Erratic voltage reading.	Defective reference tube V15.	Replace tube and adjust R95 (par. 29*a*).
2	Low impedance output wave forms:			
	Connect the 75 Ω output of the signal generator to the vertical input of the oscilloscope. Set the SYMMETRY control at mechanical center, and observe and measure output wave form from 75 Ω output connector at 1,000 cps.	Wave form nonsymmetrical. Cannot be corrected by adjustment of SYMMETRY control.	Defective multivibrator tube V2 or V3.	Replace V2 or V3. Recalibrate X 100 range (par. 29*b*). Refer to step 4.
		Leading edge of wave form rounded.	Defective amplifier tube V6, V8, or V9.	Replace.
		Voltage at 75 Ω output less than 7 volts peak to peak. The 600 Ω output should be a minimum of 55 volts peak to peak.	Defective V6, V8, or V9.	Replace.
		Output at both 75 Ω and 600 Ω outputs is less than rated values.	Defective V6 and/or V7.	Replace.
			Power supply	Refer to step 1.
		Sloping top of wave form.		
	Reduce the signal generator frequency to 20 cycles.		Defective multivibrator tube V2 or V3.	Replace V2 or V3. Recalibrate X 100 range. Refer to step 4 (dial calibration).
			Defective amplifier tubes V6 through V11.	Replace as necessary. No adjustment required.
3	High impedance output wave forms:			
	Connect the 600 Ω output of the signal generator to the vertical input of the oscilloscope. Set the signal generator for 1,000 cps.	Leading edge of wave form rounded.	Defective amplifier tube V7, V10, or V11.	Replace.
		Voltage at 600 Ω output is less than 55 volts peak to peak; 75 Ω output is at its rated value.	Defective V10 or V11	Replace.
	Check 600 Ω output at 20 cps.	Sloping top of wave form.	Defective multivibrator tube V2 or V3.	Replace V2 or V3. Recalibrate X 100 range, refer to step 4.

Step	Check	Symptom	Probable trouble	Corrective measures
	Check calibration at 1,000 cps on X 100 range using test setup shown in figure 13. Refer to paragraph 29*b* for adjustment details.	Slight deviation	Out of adjustment	Adjust R18 (fig. 11) for proper calibration of FREQUENCY dial at 1,000 cycles.
		Unable to correct calibration with R18.	Defective multivibrator tubes V2 and V3.	Replace. Recalibrate X 100 range.
			Defective diode clamp tube V4.	Replace. Recalibrate X 100 range.
5	Sync trigger:			
	Apply a 1,000-cycle signal of 5 volts peak to the SYNC IN connector (fig. 14).	No synchronization	Defective trigger tube V1.	Replace. Adjust sync sensitivity (par. 29*d*).
	Set the FREQUENCY dial of the signal generator to 980 cycles, RANGE switch at X 100.	No synchronization	Defective trigger tube V1.	Replace V1. Adjust SYNC sensitivity (par. 29*d*).
	Check range of sync to 950 cycles on dial.	Sync will not hold over range.	Defective diode CR1 or defective trigger tube V1.	Replace defective component and adjust sync sensitivity (par. 29*d*).

27. Special Requirements

To service and adjust the signal generator, the following test equipment must be available to the repairman. Otherwise, the equipment must be referred to field or depot maintenance personnel for repair or adjustment.

a. An *accurate* voltmeter (such as Voltmeter TS–443/U) with a range of 0 to 250 volts direct current (dc) and an accuracy of 1 per cent.

b. A high speed oscilloscope with provisions for direct connection to the vertical deflection plates. Oscilloscope AN/USM–50 or similar equipment may be used.

c. A wide-range audio oscillator such as Audio Oscillator TS–382A/U.

28. Tube Testing and Replacement

a. Tube-Testing Techniques. When trouble occurs, make all visual checks as outlined in paragraph 25 and try to isolate the trouble to a stage before removing any tubes. If tube failure is suspected, use the applicable procedure below to check the tubes.

Caution: Do not rock or rotate a tube when removing it from a socket; pull it straight out with a tube puller. If the tube is held in place by a clamp, be sure to release it before attempting to remove the tube.

(1) *Use of tube tester.* Remove and test one tube at a time. Discard a tube only if its defect is obvious or if the tube tester shows it to be defective. Do not discard a tube that tests at or near its minimum test limit on the tube tester. Put back the original tube, or insert a new one if required, before testing the next one.

(2) *Tube substitution method.* Replace a suspected tube with a new tube. If the equipment still does not work, remove the new tube and put back the original tube. Repeat this procedure with each suspected tube until the defective tube is located.

b. Removal of Tubes. To check the tubes in the signal generator, remove the 10 screws from the edge of the front panel and the 2 from the rear of the case. Slide the panel-chassis assembly out of the case. To locate the various tubes, refer to figure 10.

c. Adjustment Following Tube Replacements. Recalibration adjustments must be made in the signal generator following replacement of certain tubes. The following chart lists all of the tubes in the equipment with reference to the required adjustment and the applicable instruction paragraph.

Tube	Type	Function	Adjustment required
V1	6BQ7	Sync trigger	Adjust sync sensitivity (par. 29*d*).
V2	6CL6	½ multivibrator	Recalibrate FREQUENCY dial (par. 29*b*).
V3	6CL6	½ multivibrator	Recalibrate FREQUENCY dial (par. 29*b*).
V4	6AL5	Diode clamp	Recalibrate FREQUENCY dial (par. 29*b*).
V5	6C4	Clamp control cathode follower	Recalibrate FREQUENCY dial (par. 29*b*).
V6	6CL6	75 Ω output clipper amplifier	None.
V7	6CL6	600 Ω output clipper amplifier	None.
V8	6CL6	75 Ω output tube	None.
V9	6CL6	75 Ω output tube	None.
V10	6CL6	600 Ω output tube	None.
V11	6CL6	600 Ω output tube	None.
V12	5U4GB	Full-wave rectifier	Adjust −200 v (par. 29*a*).
V13	6080	Series regulator	Adjust −200 v (par. 29*a*).
V14	6BH6	Control tube	Adjust −200 v (par. 29*a*).
V15	5651	Reference tube	Adjust −200 v (par. 29*a*).

29. Tests and Adjustments

The following paragraphs describe the test circuits required to accomplish the checks and adjustments given in paragraphs 26 and 28.

a. Power Supply. Proper operation of the signal generator depends on correct functioning of the power supply circuit. Variations in the power supply will cause the multivibrator circuits to drift off calibration and cause erratic operation in the other circuits. Whenever the signal generator is suspected of inaccurate or marginal operation, before attempting any

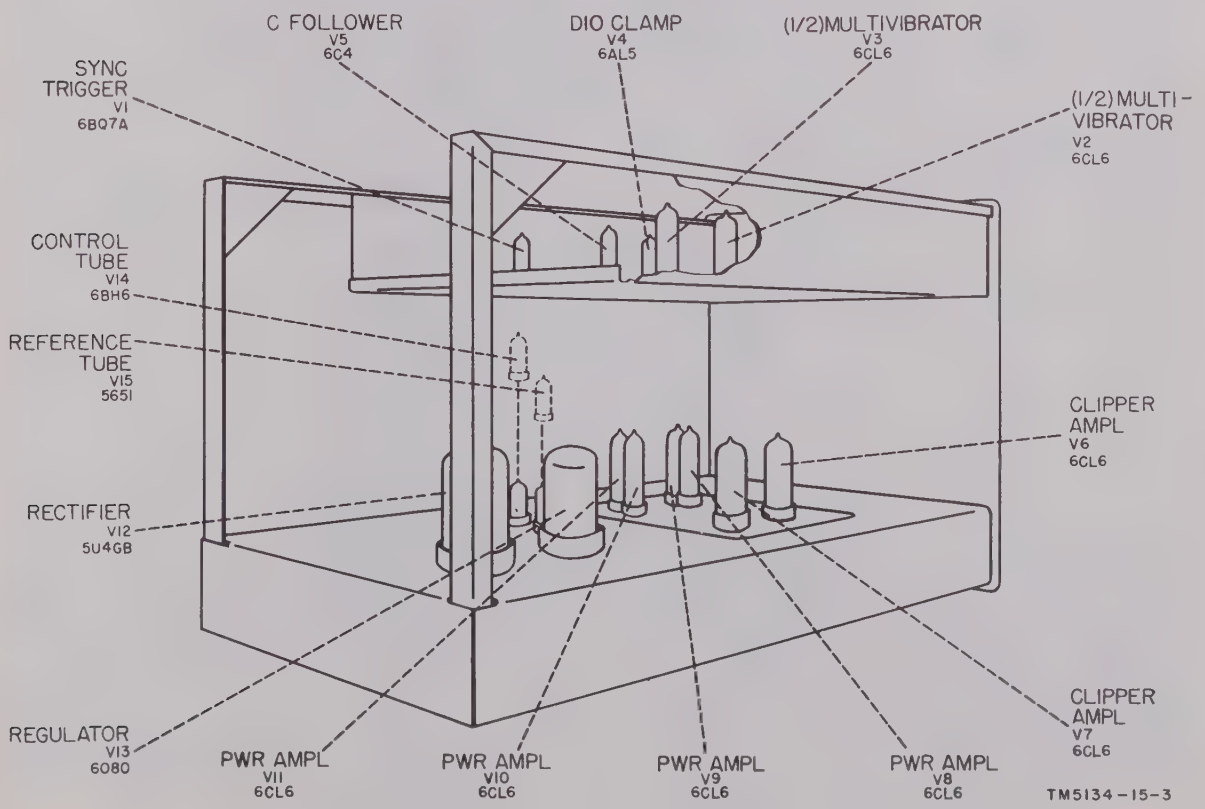


Figure 10. Tube location diagram.

other service work, *check the power* supply circuits for proper voltage as follows:

(1) Connect a precision voltmeter such as Voltmeter TS–443/U between the chassis and the end terminal of R39 (fig. 11).

(2) With the equipment operating, –200 volts dc should be indicated.

(3) Adjust this voltage with R95 to obtain *exactly* –200 volts.

(4) After adjustment, the voltage should remain within 1 percent of –200 volts dc over line voltage variations from 105 to 125 volts ac.

b. Frequency Calibration (X 100 RANGE). The basic calibration of the multivibrator circuit is made at 1,000 cps by adjusting potentiometer R18 (fig. 11). This initial adjustment is made at X 100 on the RANGE switch with the FREQUENCY dial set at 10. Resistor R8 is then adjusted with the FREQUENCY dial set at 1 to establish the proper resistance-capacitance (RC) time constant at the lower frequency of 100 cps. The other ranges are calibrated by adjusting the timing network (*c* below). All other ranges are referenced to range of X 100 which must, therefore, be calibrated first. In most cases, recalibration at X 100 on the RANGE switch is the only adjustment necessary after replacing V2, V3, V4, or V5 in the multivibrator circuit. Proceed as follows:

(1) Set the FREQUENCY dial of the signal generator at 10 and the RANGE switch as X 100.

(2) Connect the signal generator, oscilloscope, and audio oscillator as shown in figure 13.

(3) Set the audio oscillator for a frequency of 1,000 cps.

(4) Adjust R18 (fig. 11) until the pattern shown in figure 12 is obtained on the oscilloscope screen.

(5) Set the FREQUENCY dial of the signal generator at 1.

(6) Set the audio oscillator for a frequency of 100 cps.

(7) Adjust R8 (fig. 11) until the pattern shown in figure 12 is obtained on the oscilloscope screen.

(8) Alternate between 1,000 cps and 100 cps until the frequency is correct at both ends of the dial.

c. RANGE Switch Calibration. If it should be necessary tc recalibrate any of the ranges other than X 100, the following procedures apply. The test setup is similar to that for the range of X 100 (*b* above). For location of controls, refer to figure 11.

Note. All ranges are referenced to range of X 100; therefore, the procedure outlined in *b* above must be completed before attempting to calibrate the other ranges.

Step No.	Set RANGE switch to	Set FREQUENCY dial to	Adjust control symbol	Adjust to frequency of
1	X 100	10	R18	1 kc
2	X 1K	10	R23	10 kc
3	X 10K	5	R24	50 kc
4	X 100K	5	R25	500 kc
5	X 10	1	R21	10 cps
6	X 1	1	R20	1 cps

d. Sync Sensitivity Adjustment. When no signal is applied to the input section of trigger tube V1, it is biased approximately 3 volts below cutoff. Therefore, an input signal in excess of 3 volts peak is required to operate the sync circuit. Adjust the sensitivity of the circuit as follows:

(1) Set the FREQUENCY dial to 9.8 and the RANGE switch to X 100.

(2) Connect a sine wave signal of 1,000 cps with an amplitude of greater than 3.0 volts peak (2.2 volts root mean square (rms)) to the SYNC IN connection.

(3) Connect the equipment as shown in figure 14 and obtain the pattern shown in figure 12.

(4) Adjust sensitivity control R39 (fig. 11) until the output of the signal generator syncs with the 1,000-cps input as indicated by the pattern on the oscilloscope (fig. 12).

(5) Increase the sync signal to 5 volts peak.

(6) Decrease the FREQUENCY dial reading of the signal generator until the 1,000-cps sync control is lost. The sync control range should extend to approximately 950 cps dial reading.

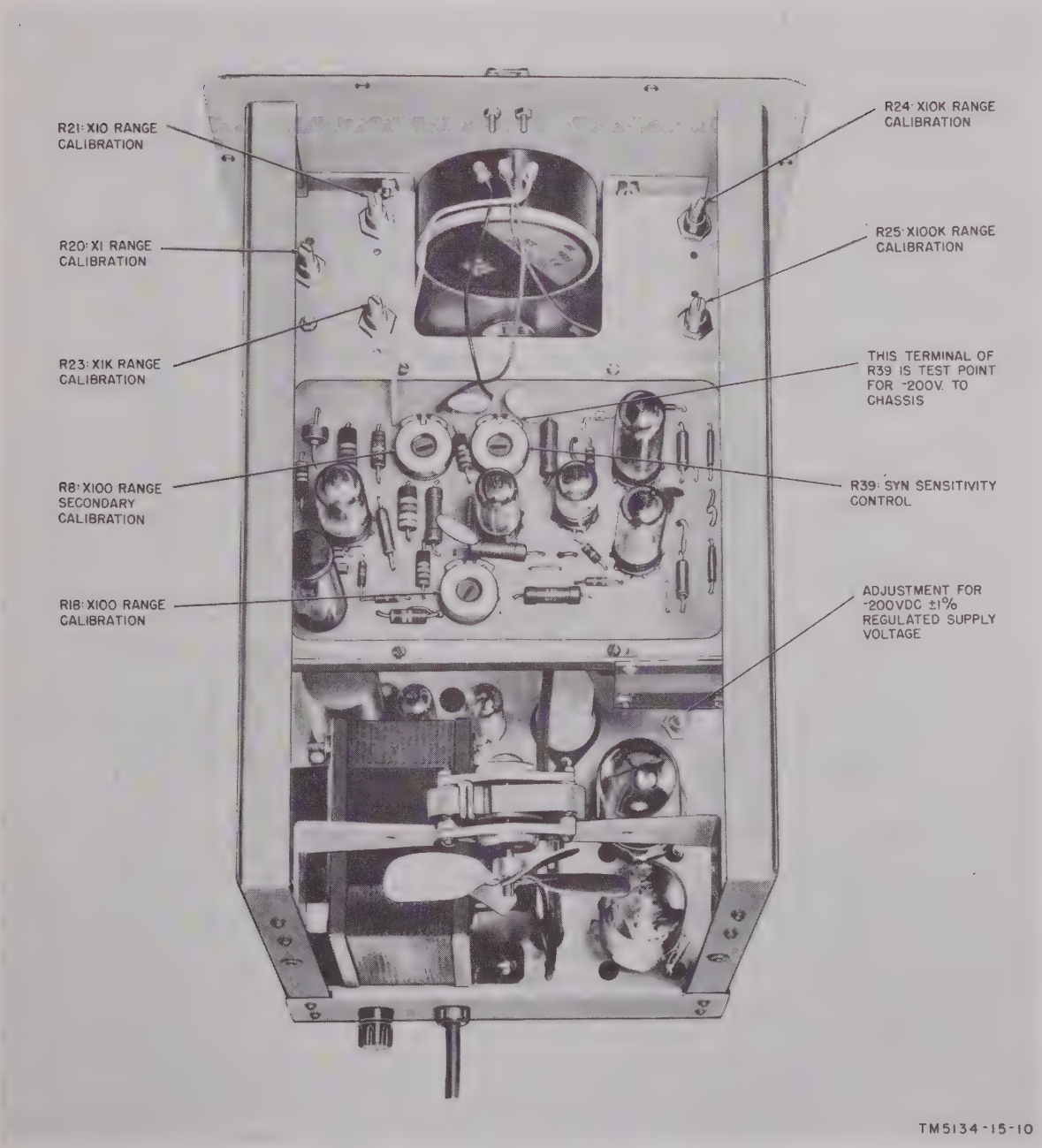

R21: X10 RANGE CALIBRATION
R20: X1 RANGE CALIBRATION
R23: X1K RANGE CALIBRATION
R8: X100 RANGE SECONDARY CALIBRATION
R18: X100 RANGE CALIBRATION
R24: X10K RANGE CALIBRATION
R25: X100K RANGE CALIBRATION
THIS TERMINAL OF R39 IS TEST POINT FOR -200V. TO CHASSIS
R39: SYN SENSITIVITY CONTROL
ADJUSTMENT FOR -200VDC ±1% REGULATED SUPPLY VOLTAGE
TM5134-15-10

Figure 11. Signal generator, calibration adjustments.

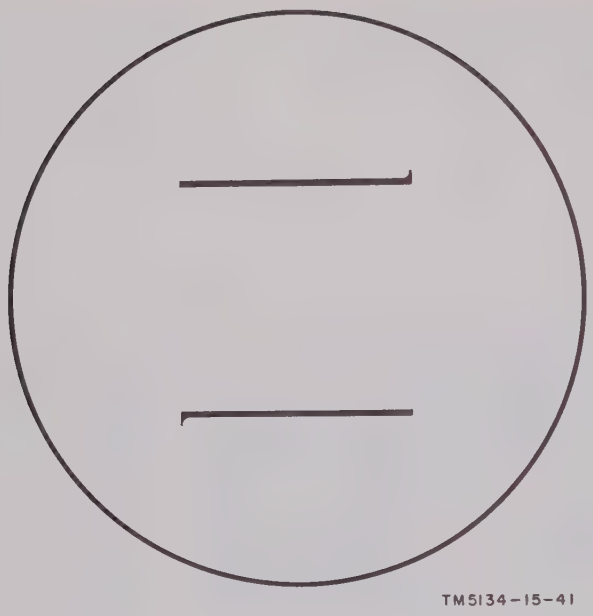


Figure 12. Square-wave, frequency-check pattern.

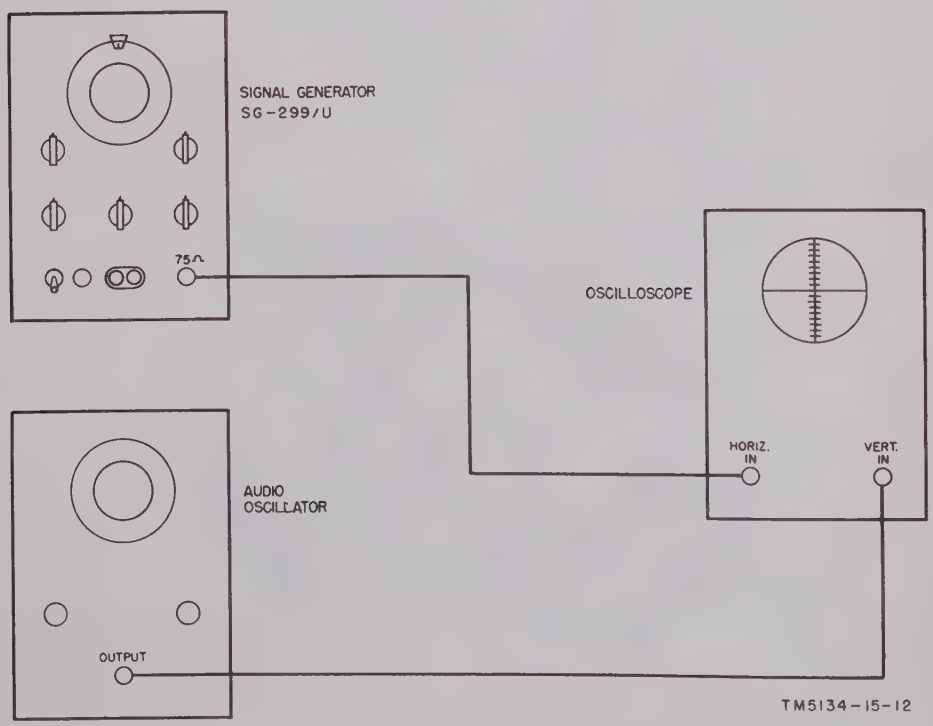


Figure 13. Test setup for calibration at 1,000 cps.

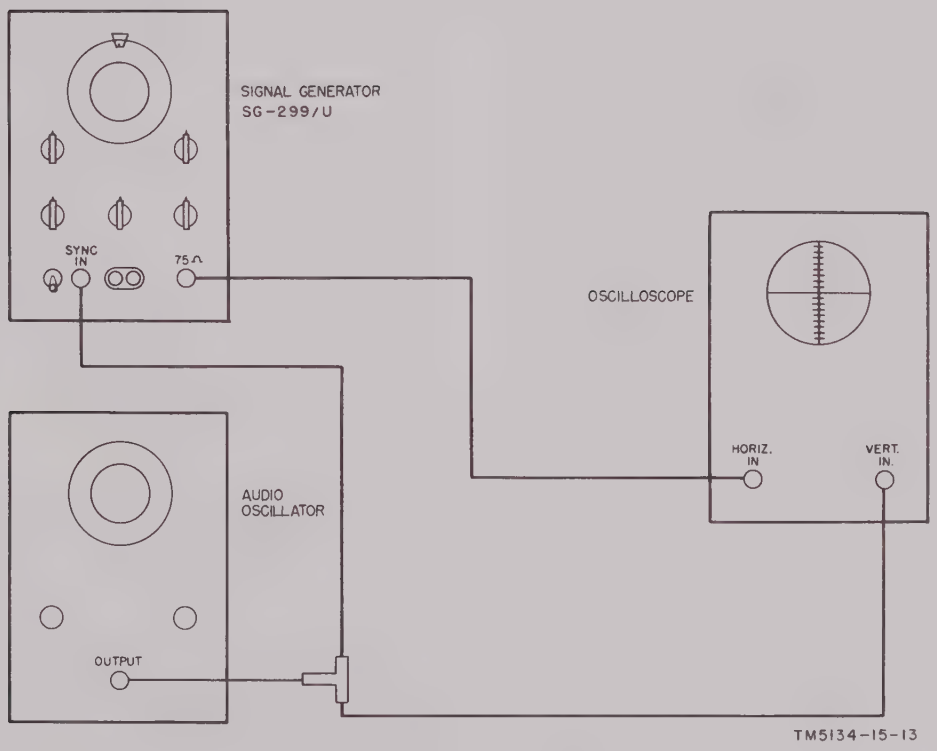


Figure 14. Test setup for adjusting sync sensitivity.

CHAPTER 4

THEORY

30. General

The signal generator is a wide-range square-wave generator used with a fast oscilloscope for testing video amplifier response characteristics. It consists of a free-running plate-coupled multivibrator which produces square-wave output signal. The frequency of the multivibrator may be adjusted from 1 cycle to 1 megacycle per second. The square-wave output of the multivibrator is fed to a push-pull clipper amplifier stage which, in turn, feeds a power stage consisting of four tubes connected in push-pull parallel. The power amplifier stage is terminated in two separate output systems. The 75-ohm output is adjusted by a variable amplitude control and a 60-db four-step constant impedance attenuator network. The 600-ohm is adjusted by a two-section balanced-amplitude control. The two outputs can be used separately or simultaneously. A trigger circuit coupled to the multivibrator permits synchronization of the signal generator with an external signal source. To maintain stable operation of the equipment, plate voltage for the various circuits is supplied by a regulated power supply designed to maintain a constant dc output voltage within ±1 percent over line voltage variations from 105 volts to 125 volts ac.

31. Block Diagram

The block diagram of the signal generator (fig. 15) is described in *a* through *g* below. For complete circuit details, refer to the schematic diagrams at the back of the manual.

a. Sync Trigger. The sync trigger accepts an external synchronizing signal (positive pulse or sine wave) from SYNC IN jack J1 and converts it into a spike shaped output signal. This output, from sync trigger tube V1, is coupled through crystal diode CR1 to V2 to control the multivibrator frequency.

b. Plate-Coupled Multivibrator. Pentode tubes V2 and V3 are used as a plate-coupled multivibrator circuit. Clamping diodes (dual sections of V4) are used with cathode follower V5, the clamp control tube, to stabilize the output of the multivibrator. The multivibrator is in a free-running mode if no external synchronizing signal is applied through the sync trigger circuit. The RANGE switch selects the proper RC time constant to be inserted in the circuit and, with the FREQUENCY control, determines the operating frequency. The push-pull output from the multivibrator furnishes the driving voltage for clipper amplifiers V6 and V7.

c. Clipper Amplifiers. The clipper amplifiers shape the signals from the multivibrator and provide the square-wave driving signal voltage for the power amplifier.

d. Power Amplifier. Four type 6CL6 tubes, V8, V9, V10, and V11, are connected in a push-pull parallel arrangement in the power amplifier. The signals from the clipper amplifiers are coupled to the power amplifier tubes, which amplify and deliver the square-wave output to individual output attenuators.

e. 75-ohm Output. The output of power amplifiers V8 and V9 is coupled through the 75 Ω OUTPUT AMPLITUDE control and the 75 Ω ATTEN switching circuit to 75-ohm output connector J2.

f. 600-ohm Output. The output of power amplifiers V10 and V11 is coupled through the 600 Ω OUTPUT AMPLITUDE control to 600-ohm output connector J3.

g. Power Supply. An ac line voltage is impressed across the primary of power transformer T1. The secondary windings of T1 suplies all filament and heater voltages and the necessary high voltage for operation of full-wave rectifier V12. Series regulator V13, control tube V14, and reference tube V15, form a feedback control system to minimize any shift of the −200-volt dc plate supply.

32. Multivibrator (fig. 16)

a. The multivibrator in the signal generator uses two 6CL6 tubes connected in an RC plate-coupled multivibrator circuit. Capacitors CX1

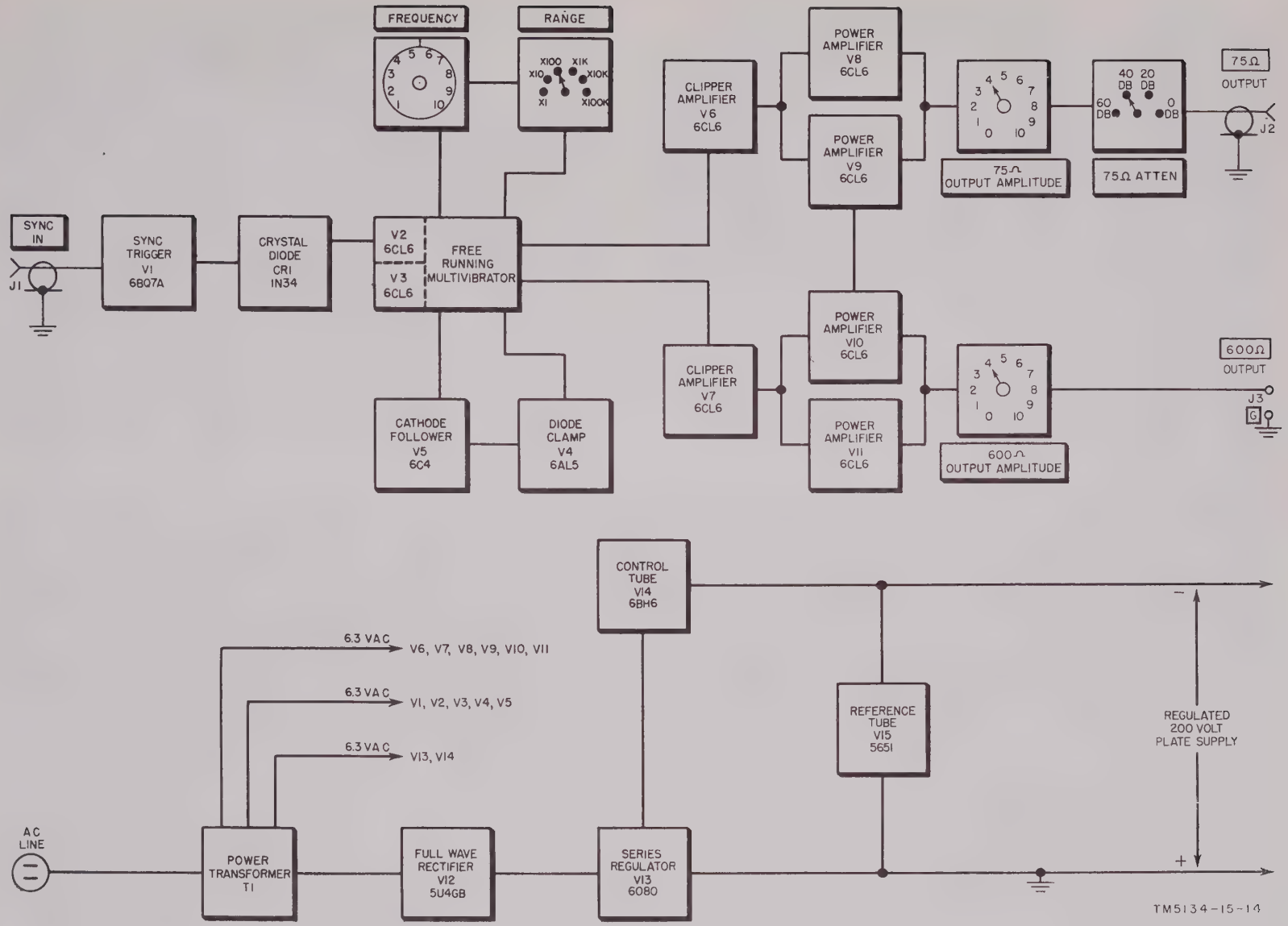


Figure 15. Block diagram.

and CX2 provide coupling between the two sections of the multivibrator and, in conjunction with grid resistors RX1, RX2, and RX3, comprise a timing network which determines the range of multivibrator frequency. The values of these components are changed for each frequency range by the RANGE switch (par. 33 and fig. 17). FREQUENCY control R9, provides a variable grid-return voltage which results in a frequency adjustment on each range in a ratio of 10 to 1.

b. A negative type power supply is used throughout this signal generator. Thus, the plates of all amplifier tubes are returned to ground. Tubes V2 and V3 alternately conduct and cut off. With V2 not conducting, CX1 charges to the full value of the plate supply voltage. The coupling of CX1 to the grid of V3 through R37 causes the grid of V3 to become more positive, thereby increasing plate current through V3. The plate voltage of V3 decreases because of the voltage drop across its plate load R40 and L4. This change in voltage is coupled through CX2 and R4 to the grid of V2, driving V2 beyond cutoff. When the plate current of V3 stabilizes and there is no further change in plate voltage, the bias on V2 decreases above cutoff through resistors RX2, RX3, and R9, thereby allowing V2 to conduct. When V2 conducts, its plate voltage decreases because of the drop across its plate load, R3 and L1. This drop is coupled through CX1 and R37 to the grid of V3, driving V3 into cutoff. Resistors RX1, RX3, and R9 form the grid leak resistance for V3, enabling it to return to a conducting state to complete one cycle of operation.

c. FREQUENCY control R9, with calibration resistor R8 and fixed resistor R7, serves as a voltage divider across the −200-volt supply. Varying FREQUENCY control R9 changes the bias on the multivibrator tubes and, in turn, the frequency of operation. Resistor R34 serves at the cathode return for V2 and V3.

d. Diode clamp circuit consisting of V4 and V5 limits the peak voltage applied to the grids of V2 and V3 and improves the square-wave output from the multivibrator. The cathodes of the diode clamps are returned through R27 (cathode resistor for V5) to the −200-volt supply. These clamp tubes remain cut off (because the cathodes are negative with respect to the plates) until the grid voltage applied to the multivibrator exceeds the negative voltage at the cathoes of the diode clamps. This voltage causes the plates of the diode clamps to become positive and the diode clamps conduct, thus limiting the peak voltage applied to the grid of V2 and V3.

e. Operating bias of V4 is determined by the drop across cathode resistor R27. The current through cathode follower V5 can be adjusted by variable resistor R18 which, in series with resistors R26 and R15, serves as a voltage divider across the −200-volt supply. Capacitors C10 and R19 are included in the circuit to reduce the effects of parasitics.

f. The output of the multivibrator is a square wave form. SYMMETRY control R17 balances the periods of conduction from the two halves of the circuit. The output of V2 and V3 is fed to capacitors C19 and C28, and then to the clipper amplifiers. Resistors R5 and R35 are parasitic resistors inserted in the screen grids of V2 and V3 for more stable operation.

33. RANGE Switch
(fig. 17)

The function of RANGE switch S1 is to switch different RC time constants into the multivibrator circuit for the various frequency ranges. It is a six-position wafer-type switch with 60° indexing between positions.

a. On the X 1 range, capacitor C12 is connected between the plate of V3 and the grid of V2. Resistor R28 is the grid resistor for V2 on this range. Capacitor C1 is connected between the plate of V2 and the grid of V3; resistor R10 is the grid resistor for V2 on this range. The junction of resistors R28 and R10 is connected through X 1 calibration control R20 to FREQUENCY control R9.

b. On the X 10 range, capacitors C13 and C2 replace capacitors C12 and C1, and resistors R29 and R11 replace resistors R28 and R10. The junction of R29 and R11 is connected through X 10 calibration control R21 to FREQUENCY control R9.

c. On the X 100 range, capacitors C14 and C3 replace capacitors C13 and C2. The junction of resistors R29 and R11 is connected through resistor R22 to FREQUENCY control R9.

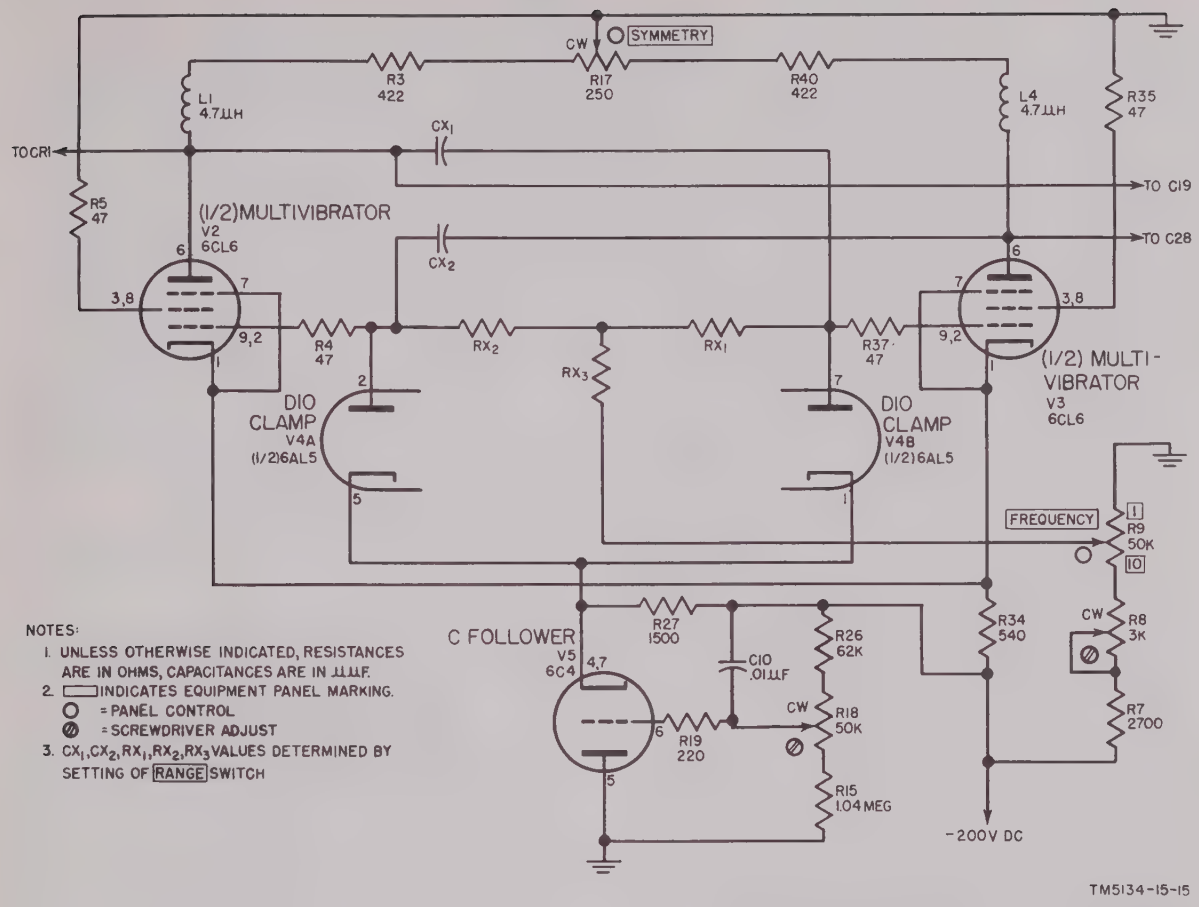


Figure 16. Simplified multivibrator circuit.

d. On the X 1K range, capacitors C15 and C4 replace capacitors C14 and C3. The junction of resistors R29 and R11 is connected through X 1K calibration control R23 to FREQUENCY control R9.

e. On the X 10K range, capacitors C16 and C5 replace capacitors C15 and C4, and resistors R30 and R12 replace resistors R29 and R11. The junction of resistors R30 and R12 is connected through X 10K calibration control R24 to FREQUENCY control R9.

f. On the X 100K range, capacitors C17 and C6 replace capacitors C16 and C5, and resistors R31 and R13 replace resistors R30 and R12. The junction of R31 and R13 is connected through X 100K calibration control R25 to FREQUENCY control R9.

34. Sync Trigger
(fig. 18)

a. When synchronization is required, an external sync signal is injected into SYNC IN jack J1. This external signal is impressed across resistor R32 through dc blocking capacitor C8, and coupled to the grid of V1A through parasitic suppressor R16. Resistors R6 and R38 comprise a voltage dividing network that biases the input grid of V1A beyond cutoff. Application of a positive-going pulse of at least a 3-volt peak drives V1A into conduction. The increased voltage drop across resistor R1 causes the plate voltage of V1A to drop. The inductive action of L2 produces a sharp leading edge on the wave form at the plate of V1A.

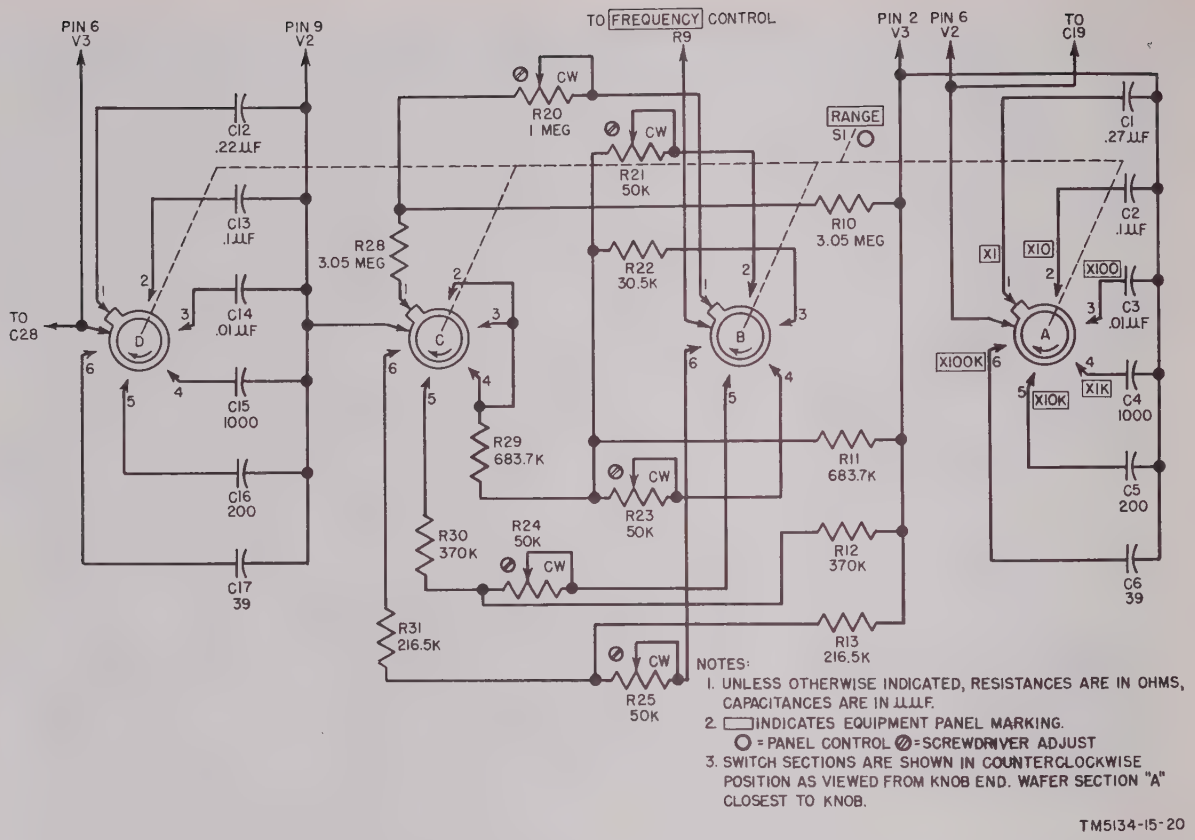


Figure 17. RANGE switch diagram.

b. Section V1B is normally conducting. When the plate of V1A goes negative, V1B is driven to cutoff due to the coupling through capacitor C9 and resistor R14. Inductance L3 in the plate circuit of V1B offers zero impedance when this section of the tube is conducting, thereby effectively shorting out resistor R2. However, when V1B is cut off by application of a sharp pulse to the grid, L3 presents a very high impedance to the pulse and R2 becomes the effective plate load. V1B reaches a steady state of cutoff during the pulse period and L3 again presents zero impedance until the tube is driven into conduction by the trailing edge of the pulse. Inductor L3 again presents a high impedance and R2 again becomes the effective load. Thus the output of V1B is differentiated, thereby producing a series of alternate spikes.

c. The negative spikes produced by V1B are coupled through crystal rectifier diode CR1 to the plate of V2, thereby providing synchronization for the multivibrator with an external signal voltage.

d. When using external synchronization, the negative spike from the sync trigger circuit, coupled to the grid of V3 (fig. 16) through CR1, cuts off V3. To obtain proper synchronization in the multivibrator, the negative cutoff pulse from the trigger must reach the grid of V3 before the tube reaches cutoff as a result of normal free running operation. To accomplish this, the multivibrator must be adjusted to a frequency slightly lower than that of the incoming synchronizing signals.

e. Variable resistor R39, together with R33, controls the sensitivity of the sync trigger circuit. It is adjusted so that the system will trigger on a minimum sync input signal of 3 volts peak. In practice, it is recommended that a 5-volt peak sine wave or positive pulse signal be used.

f. Resistor R36 serves as a common cathode bias resistor to limit current through both sections of V1.

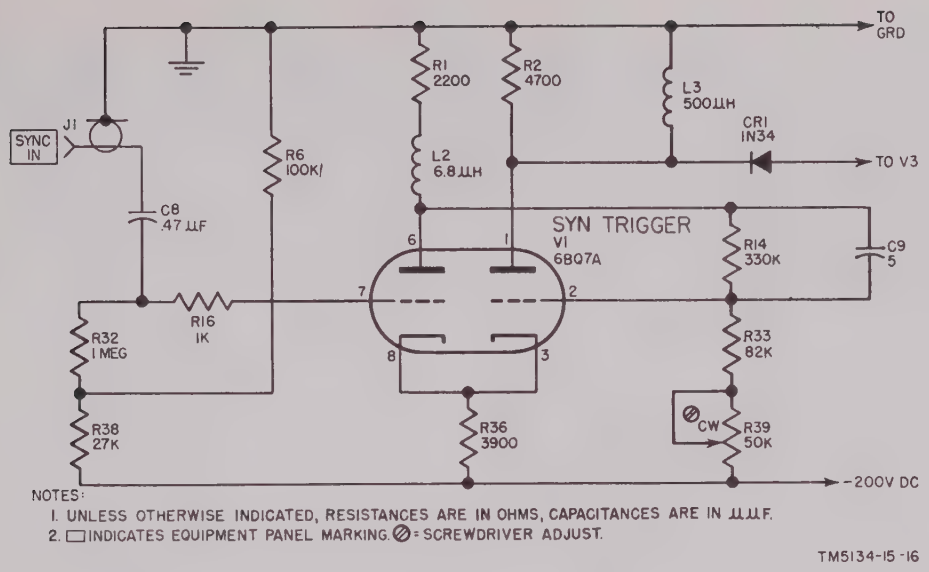


Figure 18. Simplified sync trigger circuit.

35. Clipper Amplifier (fig. 19)

a. The output of multivibrator tubes V2 and V3 is coupled through capacitors C19 and C28 to provide a push-pull driving signal for the two 6CL6 clipper amplifier tubes V6 and V7. This push-pull signal from the multivibrator drives clipper amplifier tubes V6 and V7 alternately into cutoff and into saturation, thereby producing amplified, square-topped, output signals at the plates of V6 and V7.

b. The input signals are impressed across grid resistors R54 and R70 and connected through parasitic suppressor resistors R52 and R73 to the control grids of V6 and V7 respectively. Resistors R41, R45 and R60 form a voltage divider across the —200-volt dc supply to provide a fixed bias for the grids of V6 and V7. Self bias for both tubes is provided by the common cathode resistor R61. Resistors R46 and R78 are inserted in the screen circuits to prevent parasitics.

c. The plate load of V6 consists of two parallel resistors, R42 and R43, in parallel with a frequency compensating network made up of R47, C18, L5, R55, R62, and C23. A similar circuit made up of parallel resistors R81 and R82 in parallel with the frequency compensating network R79, C30, L6, R71, R67, and C24 serves as the plate load for V7.

d. At low frequencies, R42 and R43 serve as the plate load for V7. However, as the frequency increases, the impedance of the compensating networks decreases and the networks function increasingly as a part of the effective plate loads for V6 and V7. This action of the compensating networks permits handling a wide band of frequencies by the clipper amplifier while maintaining the desired frequency response characteristics. The overall frequency response is further maintained by dc coupling to the power amplifier stage.

36. Power Amplifier and 75 Ω ATTEN Control

a. Power Amplifier (fig. 20).

(1) The power amplifier consists of four type 6CL6 pentodes connected in push-pull parallel. The outputs from the clipper amplifier drivers, V6 and V7, are 180° out-of-phase with each other, therefore one half of the output amplifier is conducting while the other half is cut off.

(2) Outputs from the clipper amplifier tubes are directly coupled from the plate load networks of V6 and V7 through parasitic suppressor resistors R48, R50, R76 and R80 to the grids of power amplifiers, V8, V9, V10 and V11.

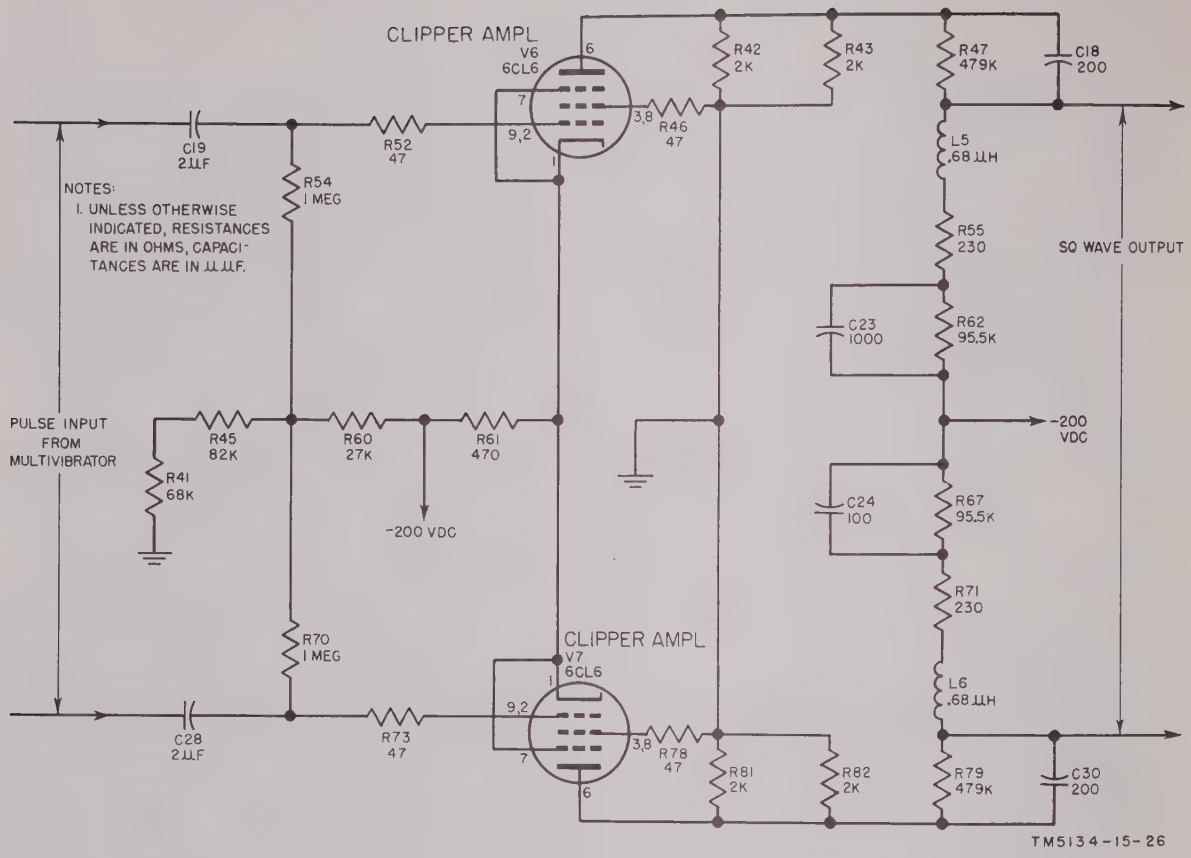


Figure 19. Simplified clipper amplifier circuit.

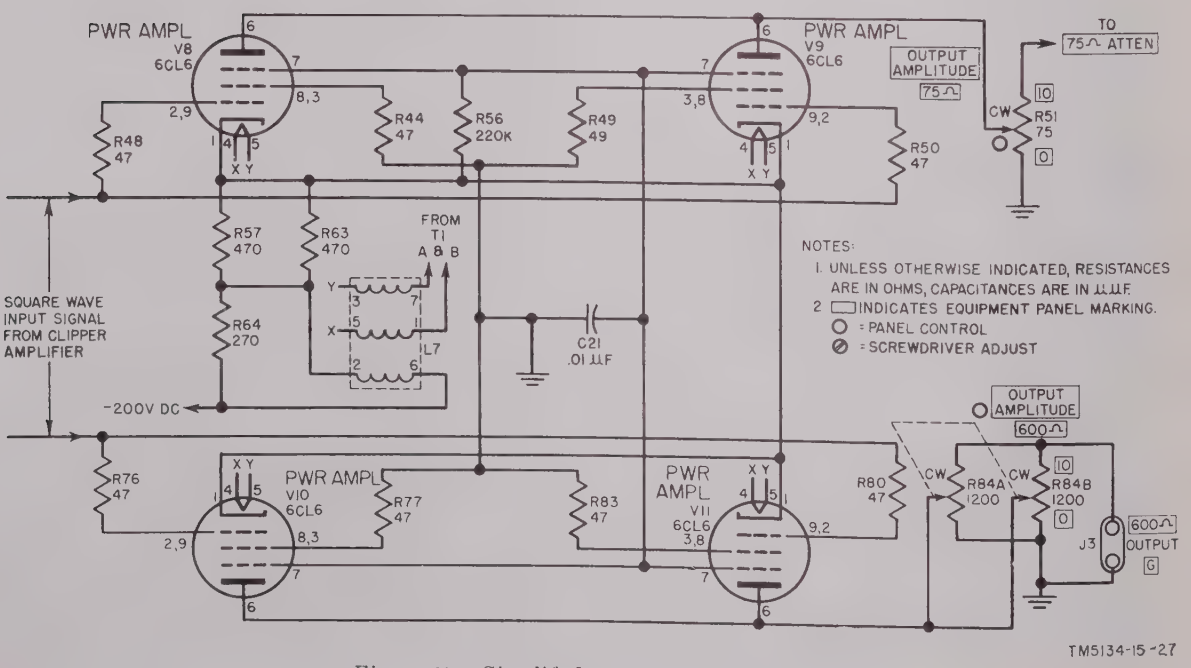


Figure 20. Simplified power amplifier circuit.

(3) The power tubes alternately switch from conduction to cutoff. Due to the heater-cathode capacitance a transient effecting the leading and trailing edges of the wave form is introduced. A compensating network, consisting of resistors R57, R63, R64 and inductance unit L7, inserted in the common cathode circuit of the power amplifiers, introduces a corrective transient of opposite polarity to that produced by the interelectrode capacitance. The other sections of L7 are inserted in series with the filament circuits of the power amplifier tubes (fig. 40) and keep radio frequency (RF) out of the filament line. Resistor R56 is a common suppressor resistor for the suppressor grids.

(4) Each half of the push-pull parallel power amplifier is connected to a separate output system. The output of V8 and V9 is connected to 75 Ω OUTPUT AMPLITUDE control R51 which adjusts the voltage input to the 75 Ω ATTEN control. The output of V10 and V11 is connected to the 600 Ω OUTPUT AMPLITUDE control R84A and R84B which adjusts the voltage level at 600-ohm output connector J3.

(5) Resistors R44, R49, R77, and R83 are parasitic resistors inserted in the screen grids of the output tubes to minimize the effects of transients. Capacitor C21 bypasses the suppressor grids of the output tubes to ground.

b. 75 Ω ATTEN Control (fig. 21). The 75 Ω ATTEN control is a three-section pi-type attenuator, each section introducing a 20-decible (db) loss when switched into the circuit. The switch has four positions.

(1) In the O DB position (fig. 21 shows the switch in the 60 DB position), the 75 Ω OUTPUT AMPLITUDE control is connected directly to 75-ohm jack J2.

(2) In the 20-DB position, the 75-ohm signal is connected to the junction of voltage divider resistors R53 and R59. The voltage across R58 and C20 is connected to 75 ohm output jack J1.

(3) In the 40 DB position, the voltage across R58 and C20 is connected to the junction of voltage divider network, C22, R66, and R68. The voltage across R69 and C26 is connected to the 75-ohm output jack J2.

(4) In the 60 DB position, the voltage across R69 and C26 is connected to the junction of voltage divider network R72, R74, and C27. The voltage across R75 and C29 is connected to 75-ohm output jack J2.

37. Power Supply
(fig. 22)

To insure proper operation of the signal generator, it is essential that all dc voltages are regulated and free from ripple or noise. Special regulating features are therefore included in the power supply circuit.

a. Power transformer T1, supplies all of the necessary ac voltages for the operation of the signal generator. The primary of the power transformer consists of two windings, normally wired in parallel for 115-volt operation. When 230-volt operation is required, the dual primaries are wired in series. The ac line voltage from P1 is fed through power switch S3 and fuse F1 to the dual primaries of T1. Fan B1 is connected across one primary and provides forced ventilation for the signal generator. A type 5U4GB full-wave rectifier tube, V12, fed by the high voltage winding of the transformer, provides an unregulated dc output voltage. A high-capacity input filter C31, comprised of one 40-microfarad (μf) section and two 20-μf sections connected in parallel for a total capacity of 80 μf, minimizes any ripple present in the output of the rectifier.

b. A cathode follower regulator tube, V13, is connected between the unregulated dc voltage and chassis ground. The cathode resistance of this tube is made up for resistors R94, R95, and R96 in parallel with the power supply load between chassis ground and the −200-volt supply. Grid bias for feedback amplifier tube V14 is taken from the center arm of calibrating resistor R95. A change in the bias voltage of V14 will result from any change in the voltage pres-

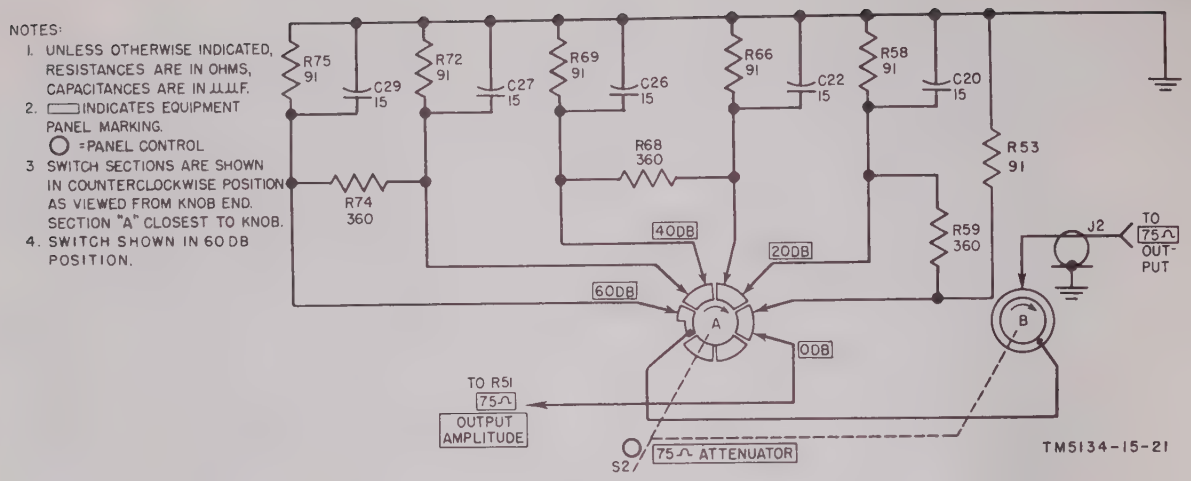


Figure 21. Attenuator switch diagram.

ent between ground (chassis) and the —200-volt supply. Resistor R89 provides decoupling between the grids of V13 which are connected to the plate of V14. Resistor R86 is the plate load of V14 and screen voltage for this tube is taken from the junction of R85 and R90. Voltage regulator tube V15 references the cathode of V14 to the —200-volt supply.

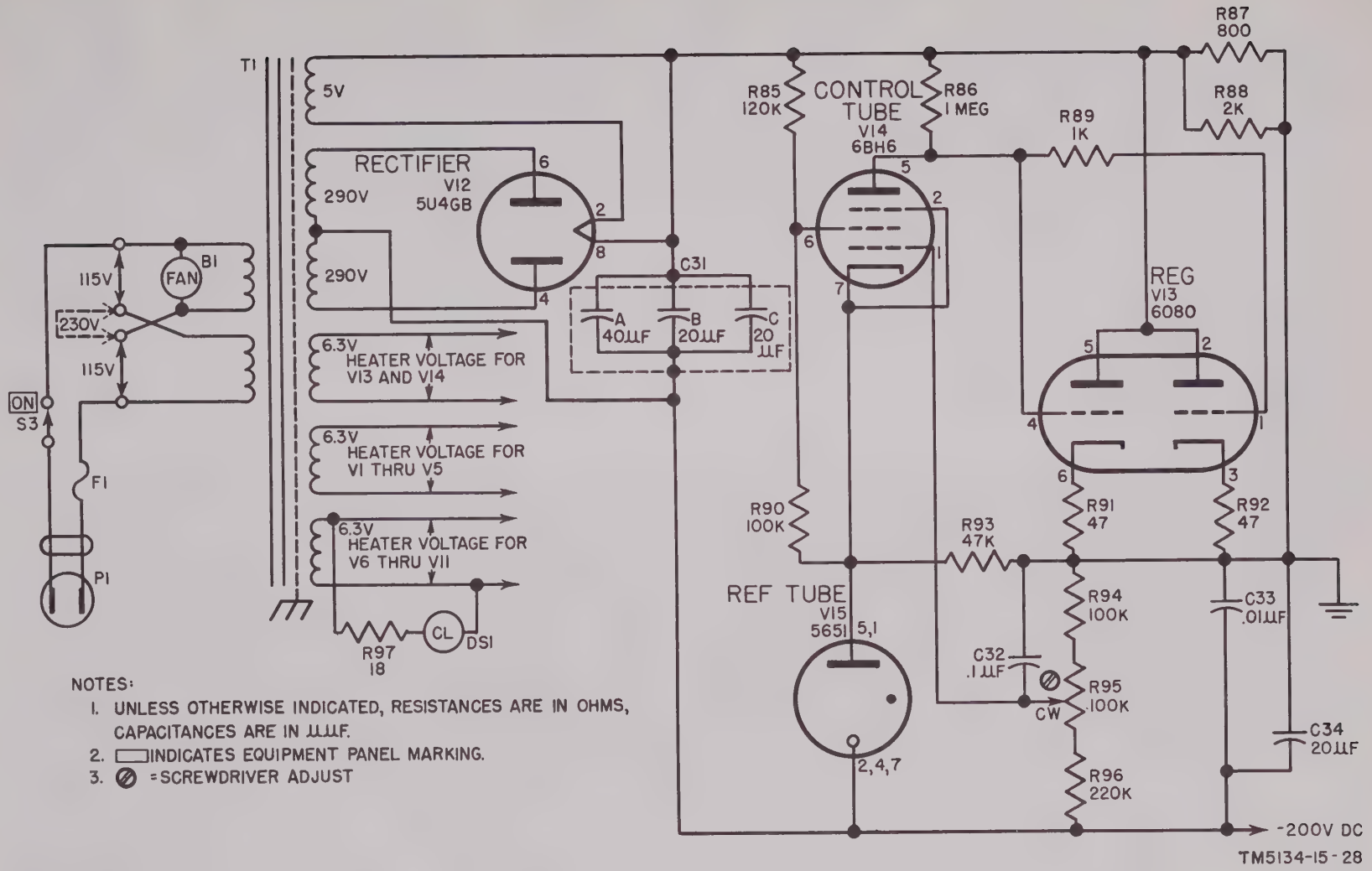
c. A change in the plate voltage of V14 will cause an identical change in the grid voltage of V13. The cathode follower action of V13 will then cause a corresponding change to take place between ground and the —200 supply. The plate voltage of V14 is dependent on the bias voltage obtained from R95. This bias voltage is controlled by the voltage across the regulated output, therefore any tendency for the output voltage to change will be compensated by a change in bias voltage applied to the control grid of V14.

d. The shunting effect of resistors R87 and R88 prevents excessive current from passing through V13. A shunt path is also provided around V15 by R93. Resistors R91 and R92 provide decoupling between the cathodes of V13. Capacitors C32 and C33 prevent transients from effecting circuit operation. Additional filtering of the regulated output voltage is accomplished by capacitor C34.

e. The output voltage can be adjusted by calibration control R95. When the proper output of —200 volts dc has been established, the regulating control circuits will maintain this voltage constant over a line voltage range of 105 to 125 volts ac.

f. The positive side of the power supply is connected to chassis ground. This permits direct coupling between the output amplifier plates and the output jacks without shock hazard.

g. Resistor R97 is connected in series with pilot light DS1 and limits the current through the pilot light.



NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN μμF.
2. ▭ INDICATES EQUIPMENT PANEL MARKING.
3. ⊘ = SCREWDRIVER ADJUST

Figure 22. Simplified power supply circuit.

CHAPTER 5

TROUBLESHOOTING

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

Warning: When servicing the signal generator, disconnect the signal generator from the power line and from other equipment before performing maintenance or troubleshooting operations which may result in physical contact with high voltages.

38. General Instructions

Troubleshooting at field and depot maintenance level includes all the techniques outlined for organizational maintenance and any special or additional techniques required to isolate and repair or replace a defective part. The systematic troubleshooting procedure, which begins with the operational and organizational checks, must be completed by means of localizing and isolating techniques, as outlined in section II of this chapter, which must be performed at field maintenance level.

39. Troubleshooting Procedures

a. General. The first step in servicing a defective signal generator is to sectionalize the fault. Sectionalization means tracing the fault to a major component or circuit responsible for abnormal operation. The second step is to localize the fault. Localization means tracing the fault to a defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, arcing, and shorted transformers, can often be located by sight, smell, and hearing. The majority of faults, however, must be localized by checking voltages and resistance.

b. Sectionalization. The signal generator is a complete, self-contained portable unit. The overall circuit may be broadly divided into five major sections for ease in servicing as follows:

Multivibrator circuit
Sync trigger circuit
Clipper amplifier stage
Output or power amplifier stage
Power supply section

The first step in tracing trouble is to locate the circuit or stage which is at fault by the following methods:

(1) *Visual inspection.* The purpose of visual inspection is to locate obvious faults without testing or measuring circuits. For example, loose or broken connectors, defective line cord plug, loose knobs, burned-out pilot lamp, broken binding post insulators, etc.

(2) *Operational tests.* Operational tests frequently indicate the general location of trouble. In many instances, the tests will help in determining the exact nature of the fault. The use of the operational check list (par. 18) and the equipment performance check list (par. 26) will generally detect and sectionalize symptoms of trouble to a particular stage.

c. Localization. The tests listed below will aid in isolating the trouble. First, localize the trouble to a single stage or circuit, and then isolate the trouble within that circuit by voltage, and resistance measurements.

(1) *Voltage and resistance measurements.* These measurements will help to locate the individual component part at fault. Use resistor and capacitor color codes (figs. 37 and 38) to find the value of the components. Use the voltage and resistance diagram (fig. 27) to find normal readings, and compare them with readings taken. Refer to paragraph 44 for dc resistance values of the power transformer windings and the various inductances used in the signal generator.

(2) *Troubleshooting chart.* The trouble symptoms listed in the troubleshooting chart (par. 42*g*) will aid in localizing trouble to a component part. Use the procedures outlined in paragraph 26

to determine the nature of the trouble before starting any service operations.

(3) *Intermittent troubles.* In all these tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. Check the wiring and connections to component parts of the equipment.

(4) *Marginal operation.* Irratic or unstable operation due to weak tubes can be quickly detected by operating the equipment at reduced line voltage. The equipment should operate satisfactorily on line voltages between 105 and 125 volts ac.

40. Test Equipment Required

The following chart lists test equipment required for troubleshooting and servicing the signal generator, the associated technical manuals, and the assigned common names used in the following paragraphs.

Test equipment	Technical manual	Common name
Audio Oscillator TS-382A/U.	TM-11-2684A	Oscillator
Frequency Meter AN/USM-26	TM 11 5057	Frequency meter
Multimeter ME-77/U*		Multimeter
OscilloscopeAN/USM-50		Oscilloscope
Electron Tube Test Set TV-2A/U.	TM 11-2661	Tube tester
Electronic Voltmeter ME-30B/U.	TM 11 5132	Vtvm
Voltmeter TS-443/U		Voltmeter
Tool Equipment TK-21/G.	SB 11-260	Service tools

*Multimeter TS-297/U may be used until Multimeter ME-77/U becomes available (TM 11-5500).

Section II. TROUBLESHOOTING SIGNAL GENERATOR

Caution: Do not attempt removal or replacement of parts before reading the instructions in paragraph 42.

41. Checking Plate Voltage Supply Circuit for Shorts

a. When to Check. When any of the following conditions exist, check for short circuits and clear the troubles before applying power.

(1) When the nature of the abnormal symptoms is not known.

(2) When abnormal symptoms reported from operational tests indicate possible power supply troubles.

b. Procedure. Remove the signal generator from its case and make the resistance measurements indicated in the following chart. If abnormal results are obtained, make the additional isolating checks outlined. When the fautly part is found, repair the trouble before applying power to the signal generator. Use the parts location illustrations (figs. 23–25) and the overall schematic diagrams (figs. 39, 40, and 41) to locate components.

c. Short-Circuit tests.

Point of measurement	Normal indication	Isolating procedure
From pins 2, 4, or 7 of V15 to chassis ground	Approximately 24,000 ohms	If resistance is zero or low, check capacitors C11, C25, C31, C33, and C34 for direct shorts or leakage. Also check for shorted wiring.
Pin 1 of V8, V9, V10, or V11	More than 24,000 ohms	If resistance is low, check C21.

42. Localizing Troubles

a. General. The procedures outlined in paragraphs 18, 26, and 41 will aid in sectionalizing trouble to a definite circuit of the signal generator. They will also, in many cases, localize the trouble to a particular part in the circuit. For the purpose of simplicity, the lists refer to the tube or tubes in a particular circuit. Remember that other circuit components associated with the tube may be the source of

trouble. If the tube is good, but trouble is still present, check the other components of that circuit.

b. Adjustments After Tube Replacement. Recalibration of certain circuits will be required when tubes are replaced. Refer to paragraph 28.

c. Voltage and Resistance Measurements. Tube socket voltage and resistance measurements are shown on figure 27. This information will help isolate trouble to a definite circuit or part. Resistance values for inductance windings and power transformer windings are tabulated under paragraph 44.

d. Location of Parts. To locate the various electrical components, refer to figures 23 through 25. The parts are called out by reference symbol designations corresponding to those used on the schematic diagrams.

e. Schematic Wiring Diagrams. The overall schematics of the signal generator are contained in figure 39, which covers the sync trigger and multivibrator, figure 40, covering the amplifier stages, and figure 41, covering the power supply. Reference to these diagrams is essential for proper servicing of the signal generator.

f. Use of Chart. This troubleshooting chart supplements the operational and troubleshooting procedures detailed in paragraphs 18, 26, and 41*c*. If previous checks have resulted in reference to a particular item on this chart, go directly to the referenced item. If no operational symptoms are known, begin with item 1 of the equipment performance checklist (par. 26) and proceed until a symptom of trouble appears.

Caution: If operational symptoms are not known, or if they indicate the presence of short circuits within the signal generator, make the short-circuit checks described in paragraph 41*c* before applying power to the unit.

g. Troubleshooting Chart.

Item	Symptom	Probable trouble	Correction
1	Fuse F1, blows when equipment is turned on.	Shorted C31	Check C31 sections A, B, and C; C11, C25, C31, and C34.
2	Indicator lamp DS1 does not light and no signal is obtained from the 75-ohm output or the 600-ohm output.	No ac power is being applied to power supply.	Check line switch S3 for continuity. Check the dual primary of transformer T1. Check fuse F1. If a blown fuse is located, check capacitors listed in Item 1 above.
3	Pilot light and tubes light but no signal is obtained from the 75-ohm or the 600-ohm output.	Failure of the −200-volt supply	Check capacitor C34 and all bypass capacitors across 200-volt supply. Check the 580-volt winding of transformer T1.
		Failure of multivibrator tubes V2 or V3.	Check L1 and L4. Measure the voltage and resistance from the pins of V2 and V3 to ground; compare these readings with figure 27.
4	No signal is obtained from the 75-ohm output; 600-ohm output is normal.	Open cable from J2 or 75 Ω ATTEN control.	Replace or repair cable.
		Defective jack J2	Replace jack J2.
		Open cable between the 75 Ω ATTEN control and the 75-ohm output amplifier tube control.	Replace or repair cable.
		Defective OUTPUT AMPLITUDE control, R51.	Check R51.
5	Signal from the 600-ohm output and the 75-ohm output is only half of rated output.	Open L7	Check L7 (par. 44).
		Defective R61	Check cathode resistor R61 for increase in resistance.
6	Signal is at its rated value at both outputs but has a distorted wave shape as shown in A, figure 26.	Defective frequency compensating capacitors C18 or C30.	Check C18 or C30.

Item	Symptom	Probable trouble	Correction
7	Signal is at its rated value at both outputs but has a distorted wave shape as shown in B, figure 26.	Defective C23 or C24	Check C23 and C24.
8	Signal is reduced 50% at the 75-ohm output; 600-ohm output is less than 3 volts peak-to-peak and appears as shown in C, figure 26.	Defective R79	Check R79.
9	Signal is reduced 50% at the 600-ohm output; signal from the 75-ohm output is zero.	Defective R47	Check R47.
10	Signal from the 600-ohm output is as shown in E, figure 26; 75-ohm output is only 3 volts peak-to-peak and appears as in D, figure 26.	Defective R62	Check R62.
11	Signal from the 75-ohm output is as shown in E, figure 26; 600-ohm output is only 20 volts peak-to-peak and appears as in figure 26D.	Defective R67	Check R67.
12	Output amplitude at its rated value but both 600- and 75-ohm outputs distorted as in F and G, figure 26.	Defective C28 or C19	Check C28 and C19.
13	No signal is obtained from the 600-ohm output; 75-ohm output is at its rated value.	Defective cable from J3 to output amplitude control.	Check cable.
14	Unable to calibrate signal generator	Defective R18, R15, R26	Check R18, R15, and R26. Recalibrate (par. 29*b*).
15	FREQUENCY control has no effect	Defective FREQUENCY control, R9.	Check R9. Recalibrate (par. 29*b*).
		Defective R7 or R8	Check R7 and R8.
16	Unable to calibrate one range or no output on one range.	Defective resistor or capacitor in RC network associated with that range.	Refer to figure 17 and check components associated with defective range.
17	Unable to synchronize multivibrator with external synchronizing signal.	Defective cable from J1 to C8	Check cable. Check voltage and resistances from socket pins of V1 to ground. Compare with values shown in figure 27.

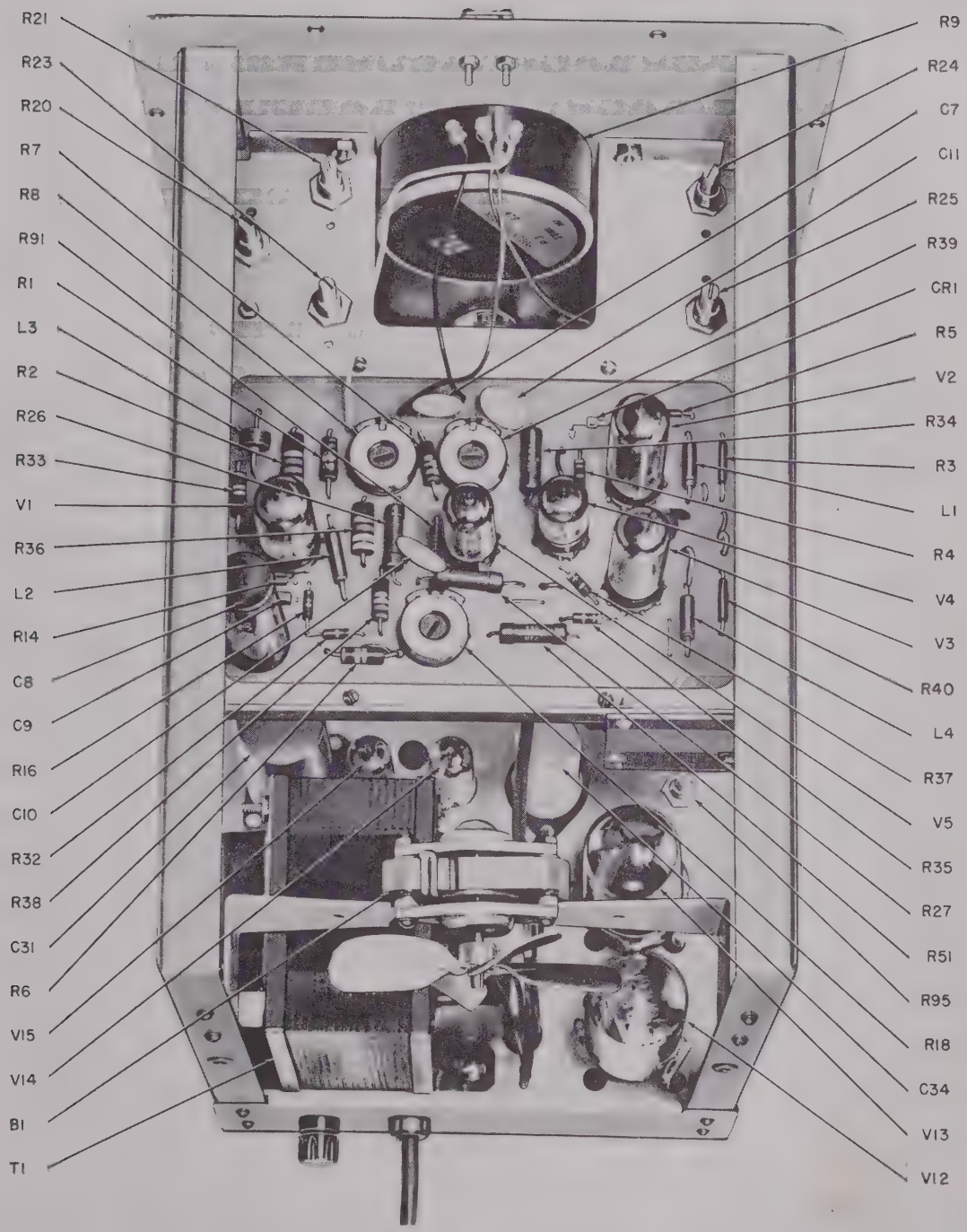


Figure 23. Signal generator, top view, showing location of parts.

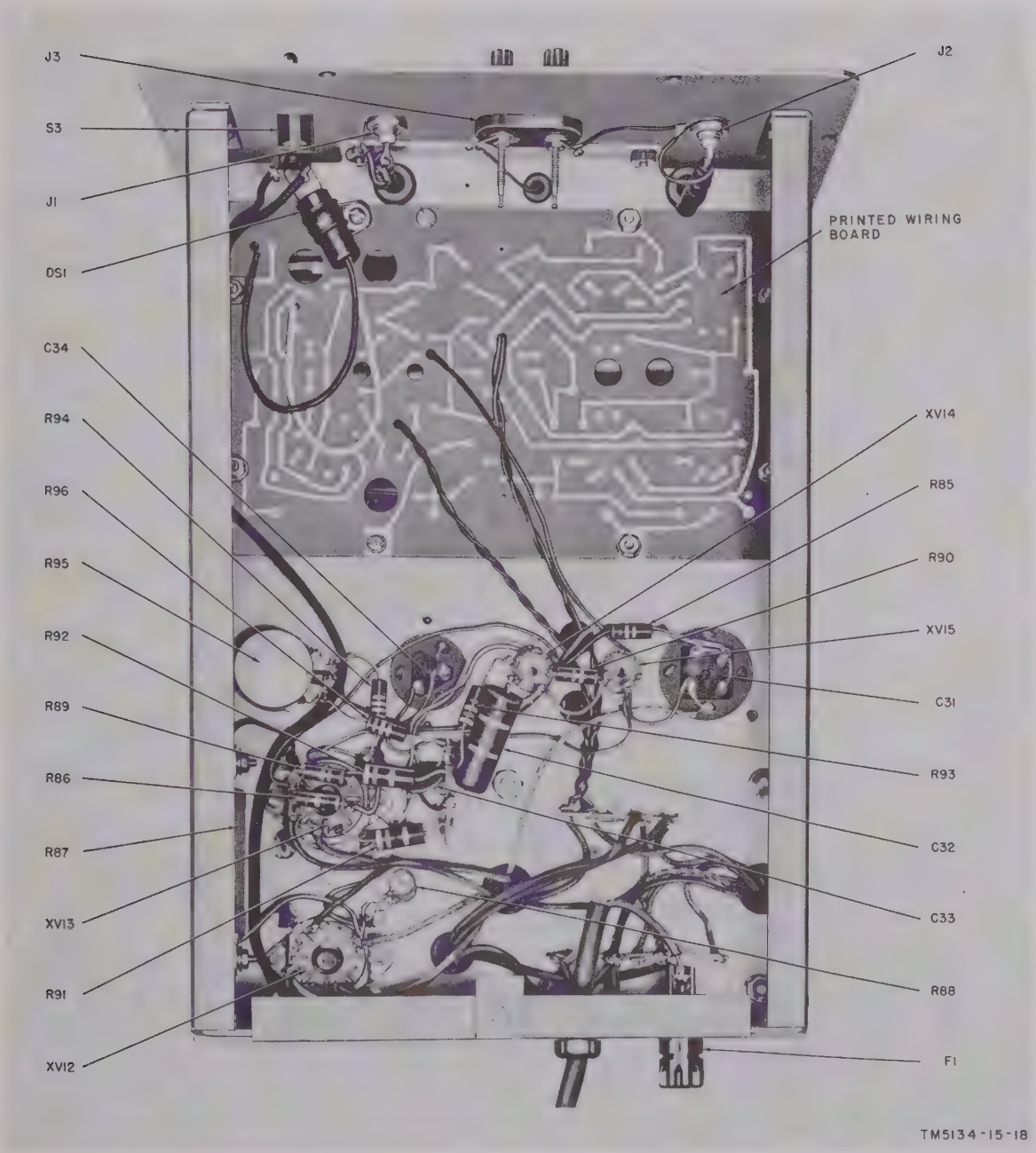


Figure 24. Signal generator, bottom view, showing location of parts.

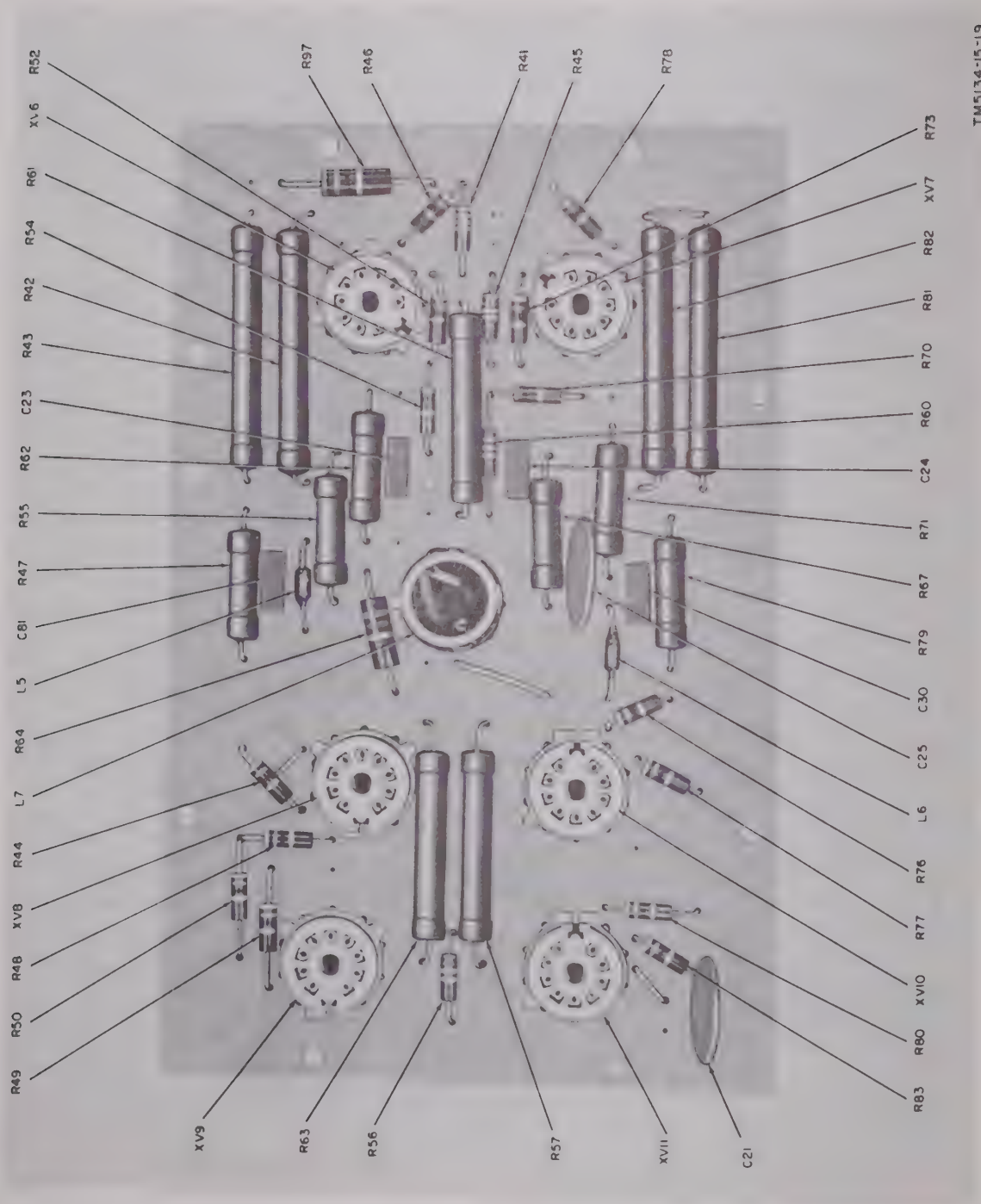


Figure 25. Terminal board, showing location of parts.

43. Isolating Trouble Within Stage

When trouble has been localized to a stage, use the following techniques to isolate the defective part.

a. Test the tube involved either in a tube tester or by substituting a tube of the same type which is known to be operating normally.

b. Take voltage measurements at the tube socket (fig. 27).

c. If voltage readings are abnormal, take resistance readings (fig. 27) to locate open and short circuits. Refer to paragraph 44 for dc resistance values of coils and transformer windings.

d. Use the schematic wiring diagram (figs. 39, 40, and 41) to trace circuits and isolate the faulty component.

44. Dc Resistances of Transformer and Coils

The resistances of the transformer windings and the coils in the signal generator are listed below.

Transformer or coil	Terminals or leads	Resistance in ohms
T1	black black-yellow	2.5
	black-red black-green	2.5
	red red-yellow, C/T red	31 (measured between the two red leads).
	brown brown	.08
	green green	.17
	slate slate	.17
	yellow yellow	.08
L1		.5
L2		.93
L3		1.85
L4		.5
L5		.13
L6		.13
L7	1 and 5	.015
	3 and 7	.015
	2 and 6	.061

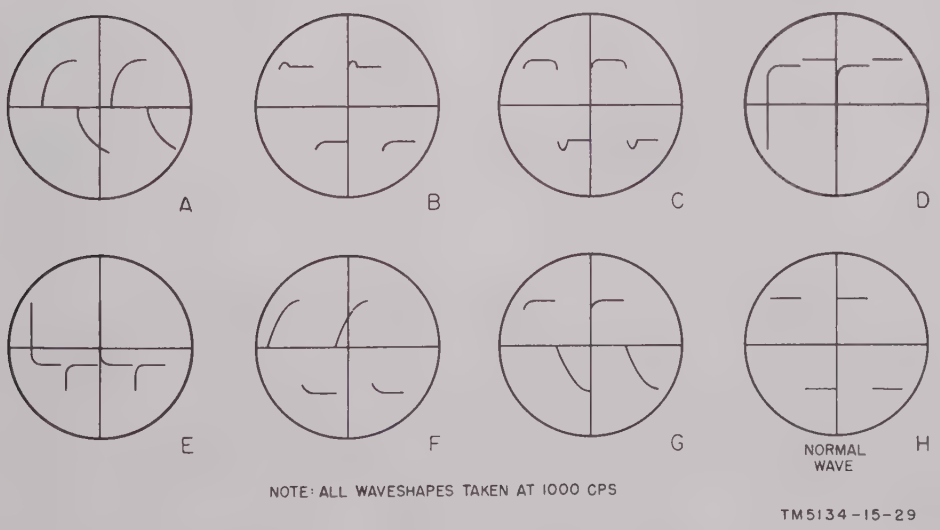


Figure 26. Wave forms for use with troubleshooting chart.

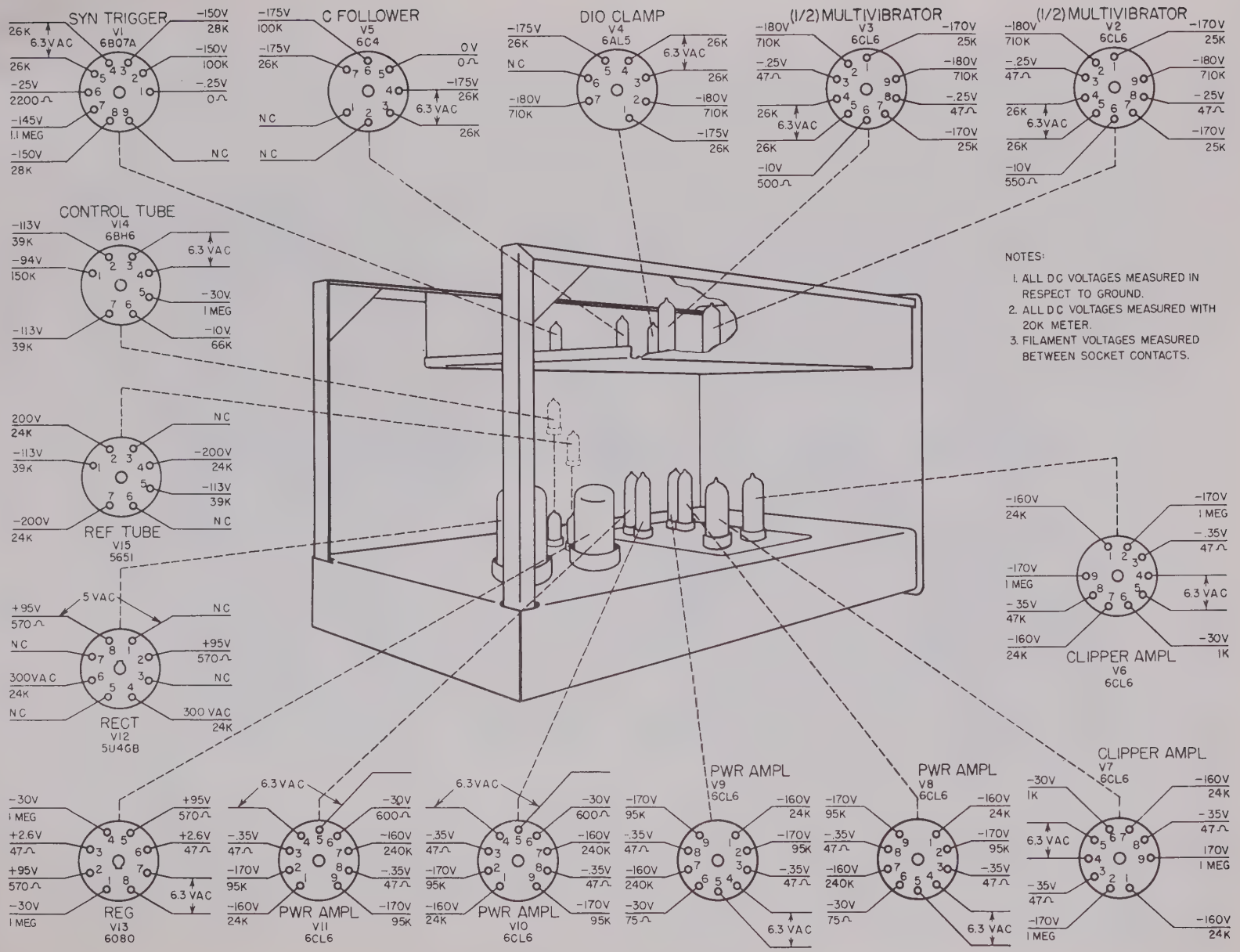


Figure 27. Tube-socket voltage and resistance diagram.

CHAPTER 6

REPAIRS AND ALINEMENT

45. General Parts Replacement Techniques

The use of two printed circuit boards in the signal generator necessitates special precautionary measures (*a–g* below) when servicing parts mounted on these boards. No special techniques are required for replacement of any of the two parts.

a. A 50-watt soldering iron, or smaller, is required. A larger iron will loosen the bond between the phenolic board and the printed wiring and will cause excessive overheating of components.

b. To test or replace a component, unsolder one or both ends by applying the heat from the soldering iron to the connection on the bottom surface of the board. When the solder melts, *remove the iron* and, with a small wire brush, brush away the solder. *More* than one heating is required to *completely remove the solder connection. However this method must be used to prevent overheating of the board.*

c. When all solder is removed, insert a knife blade between the bent-over lead of the component and the board. Apply a gentle pressure to straighten out the lead. Repeat this procedure for the other end of the component and lift the component away from the board.

d. When replacing the component, form and tin the leads before installing it onto the board. Bend the leads over on the bottom of the board so that the component will be held securely. Apply solder *sparingly.*

e. Tube sockets may be removed by applying the same procedure described in *b* and *c* above.

f. Small breaks of 1/32-inch or less in the printed circuits are repaired by jumping the break with molten solder. When a break in the printed circuits is in excess of 1/32 inch, *it should be jumped with a piece of hookup wire.*

g. When troubleshooting the printed circuit board, illuminate its printed side with a 25-watt lamp. This will permit the wiring to be seen from the component side of the board, and greatly simplify circuit tracing.

46. Test Equipment Required for Alinement

Test equipment required for alinement of the signal generator is outlined in *a* through *d* below:

a. A voltmeter with an accuracy of ±1 per cent and capable of measuring 200 volts dc, such as the Voltmeter TS–443/U, is required for the power supply adjustment.

b. An audio oscillator capable of generating a frequency of 1,000 cps and delivering an output voltage of 2.2 volts rms is required for setting the external sync sensitivity control. Audio Oscillator TS–382A/U may be used.

c. A frequency meter which will measure frequency from 10 cps to 1.1 mc with an accuracy of 1 count, plus crystal stability of .0002 percent, and which will measure periods of from .0001 cps to 10 kc with an accuracy of ±3 percent is required for the multivibrator adjustments. Frequency Meter AN/USM–26 may be used.

d. An oscilloscope which is capable of passing all frequencies from 3 cycles to 10 mc. The Oscilloscope AN/USM–50 may be used.

47. Alinement Instructions

a. Multivibrator Alinement.

(1) The various ranges of the multivibrator are adjusted by individual potentiometers R8, R18, R20, R21, R23, R24, and R25. Allow the equipment to warm up for *at least 1 hour* before proceeding with this alinement.

(2) Set the front panel controls as follows:

Control	Position
ON switch	ON
RANGE switch	X 100
FREQUENCY control	10
75 Ω ATTEN	0 DB
75 Ω OUTPUT AMPLITUDE	10
600 Ω OUTPUT AMPLITUDE	10
SYMMETRY	Midposition (white dot pointing up)

(3) The calibration of the multivibrator ranges must start with an adjustment of the X 100 range. Connect the 75-ohm output of the signal generator to the input of the frequency meter, and the 600-ohm output to the vertical input of the oscilloscope as shown in figure 32.

(4) Adjust the SYMMETRY control for a perfectly symmetrical pattern as observed on the oscilloscope. Proceed with the multivibrator alignment in the sequence outlined in the chart below:

Step No.	Set RANGE switch to	Set FREQUENCY dial to	Adjust control symbol (fig. 11)	Adjust to frequency of (kc)
1	X 100	10	R18	1
2	X 100	1	R8	.1
3	X 1K	10	R23	10
4	X 10K	10	R24	100
5	X 100K	10	R25	1000

(5) Steps 1 and 2 in the above chart are interdependent. These two procedures must be repeated until the frequency is correct at both 100 cps and 1,000 cps.

(6) The X 1 RANGE and the X 10 RANGE are adjusted by measuring the period of the square wave. The frequency meter should be adjusted for period measurements.

Step No.	Set RANGE switch to	Set FREQUENCY dial to	Adjust control symbol (fig. 11)	Adjust for 1 cycle period of (ms) (millisecond)
1	X 1	10	R20	100
2	X 10	10	R21	10

b. External Synchronization Sensitivity Adjustment. Connect the output of the audio oscillator to the SYNC IN jack of the signal generator and connect the 75-ohm output of the signal generator to the input of the frequency meter as shown in figure 30. Adjust the audio oscillator to deliver a sine wave output of 2.2 volts at a frequency of 1,000 cps. Rotate the RANGE switch of the signal generator to the X 100 position and rotate the FREQUENCY dial to 9.8. Adjust sensitivity control R39 (fig. 11) until the frequency meter indicates that the signal generator is delivering a frequency of 1,000 cps.

48. Power Transformer Conversion (fig. 39)

The signal generator may be converted for 230-volt, 60-cycle operation as follows:

a. Remove the jumper wire that connects the black lead from the power transformer to the black-green lead of the power transformer.

b. Remove the jumper wire that connects the black-red lead from the power transformer to the black-yellow lead of the power transformer.

c. Connect a new jumper wire from the black-yellow lead to the black-green lead.

d. Change the fuse to a 1.25-ampere, 250-volt fuse. As shown by the dotted line in the schematic diagram, this alteration changes the primary windings of the power transformer from a parallel to a series arrangement.

CHAPTER 7

FINAL TESTING

49. Purpose of Final Testing

The following tests are designed to measure the performance capability of a repaired signal generator. Equipment that meets the minimum standards will furnish satisfactory operation (equivalent to that of new equipment).

50. Test Equipment Required for Final Testing

The oscilloscope, the audio oscillator, the vacuum tube voltmeter (vtvm), and the frequency meter are required for final testing. Because of the extended frequency response of the signal generator, only the test equipment listed in paragraph 40 should be used for final testing.

51. Test Procedure

a. Initial Front-Panel Settings. Testing will be simplified if panel-control settings are made initially and modifications are made as required for the individual tests. The connections for the individual tests are illustrated in figures 28 through 32.

(1) Set the front-panel controls initially as follows:

Control	Position
ON switch	ON
RANGE switch	X 100
FREQUENCY control	10
75 Ω ATTEN	0 DB
75 Ω OUTPUT AMPLITUDE	10
600 Ω OUTPUT AMPLITUDE	10
SYMMETRY	Midposition (white dot pointing up)

(2) Allow at least 1 hour for all equipment to reach stabilized temperatures.

b. Symmetry Test. Connect the equipment as shown in figure 28 and set the controls as listed in *a*(1) above.

(1) Use the oscilloscope controls to present the square-wave signal completely on the screen.

(2) Check the symmetry of the observed wave form by noting the relative widths of half periods. Adjust the SYMMETRY control for equal half periods of observed wave form as shown in A, figure 29. B, figure 29 shows a nonsymmetrical square wave for comparison. Check the position of the SYMMETRY control. If it is greater than ±30° from its center of rotation, multivibrator tubes V2 and V3 are not balanced properly and one or the other must be replaced. The removed tube should not be discarded unless it is rejected by a tube tester, because it will normally operate in the clipper amplifier or output amplifier without any injurious effects.

c. Output Voltage and Attenuation Test, 75 Ohm. Connect the 75 Ω output of the signal generator to the input of the vtvm. Set the RANGE switch of the vtvm to the 10-volt range. Adjust the SYMMETRY control for maximum deflection of the vacuum tube voltmeter and note that this voltage is not less than 7 volts peak to peak (4.9 volts rms). If the voltage is less than this value, replace tubes V6, V8, and V9, in sequence; leave in the tube that returned the output of the equipment to a minimum of 7 volts peak-to-peak. Mark the db reading on the scale and use this as a 0 db reference for the following tests.

(1) Switch the 75 Ω ATTEN switch to the 20 DB position and the vtvm to its 1-volt range. The db reading must not deviate more than 1 db from its previously recorded reading.

(2) Switch the 75 Ω ATTEN switch to the 40 DB position and the vtvm to its .1-volt range. The new db reading must be within 1 db of the previous reading.

(3) Switch the 75 Ω ATTEN switch to the 60 DB position and the vtvm to its .01-volt range. The new db reading must be within 1 db of the previous reading. If the actual db attenuation at any 75 Ω ATTEN setting differs

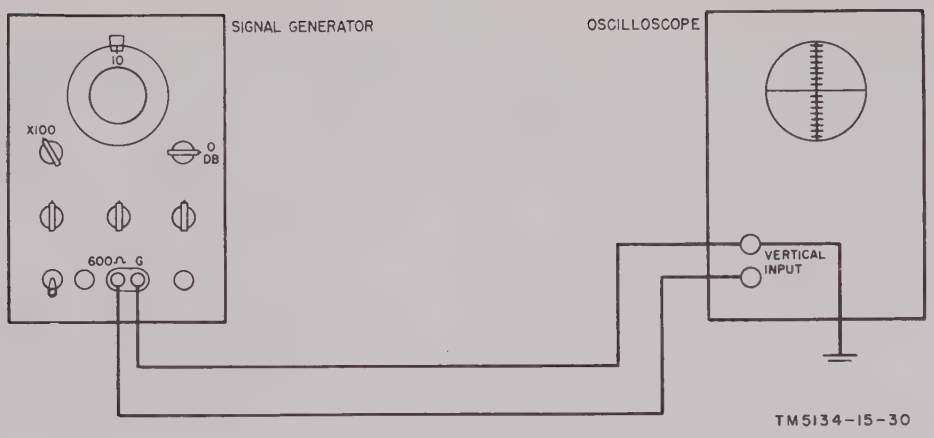


Figure 28. Connections for symmetry test.

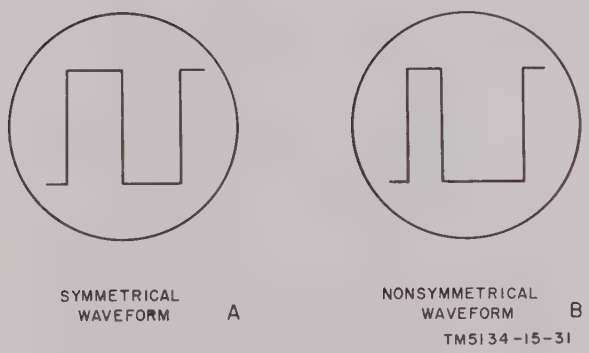


Figure 29. Symmetrical and nonsymmetrical wave forms.

from the attenuation stated on the front panel by more than 1 db, the individual components associated with that setting must be checked (par. 36*b* and fig. 21). Replace any component that differs from its rated value by more than ±5 per cent and repeat the attenuator check. Return the 75 Ω ATTEN switch to the 0 DB position.

d. Output Voltage Test, 600 ohm. Switch the vtvm to the 100-volt range and connect the vtvm to the 600-ohm output terminals of the signal generator. The 600-ohm output voltage should be in excess of 55 volts peak to peak (38.5 volts rms). If the voltage is less than this value, replace tubes V7, V10, and V11 in sequence; leave in the tube that returned the output of the equipment to a minimum of 55 volts peak-to-peak.

e. External Synchronization. Connect the signal generator to the audio oscillator and frequency meter as shown in figure 30.

(1) Adjust the audio oscillator for an output frequency of 1,000 cps and an output voltage of 3.5 volts rms (5-volt peak). Adjust the frequency meter so that a frequency of 1,000 cps can be read.

(2) Rotate the FREQUENCY control to 8.5 (850 cps) and note that the output frequency remains locked at 1,000 cps as indicated by the frequency meter. If the equipment fails to remain synchronized over the range of 850 cps to 1,000 cps, readjust synchronization sensitivity control R39 (fig. 11).

f. Frequency Calibration and Range Tracking Test. Connect the equipment as shown in figure 31.

(1) Use the controls on the oscilloscope to obtain a complete square-wave signal on the screen. Set the controls on the frequency meter to permit its use for frequency measurement.

(2) Adjust the SYMMETRY control for a symmetrical square wave as viewed on the oscilloscope (A, fig. 29).

(3) The observed frequency from the signal generator must be within the limits shown in the table below. Set the front panel controls as described for the different frequency range and record the observed frequency. A frequency that does not fall within the limits shown must be corrected by adjusting the control specified in the extreme right column of the table.

RANGE switch	FREQUENCY dial	Frequency (kc)	Upper limit (kc)	Lower limit (kc)	Calibration control (fig. 11)
X 100	10	1	1.1	.9	R18
X 100	1	1	.11	.09	R8
X 1K	10	10	11	9	R23
X 10K	10	100	110	90	R24
X 100K	10	1000	1100	900	R25

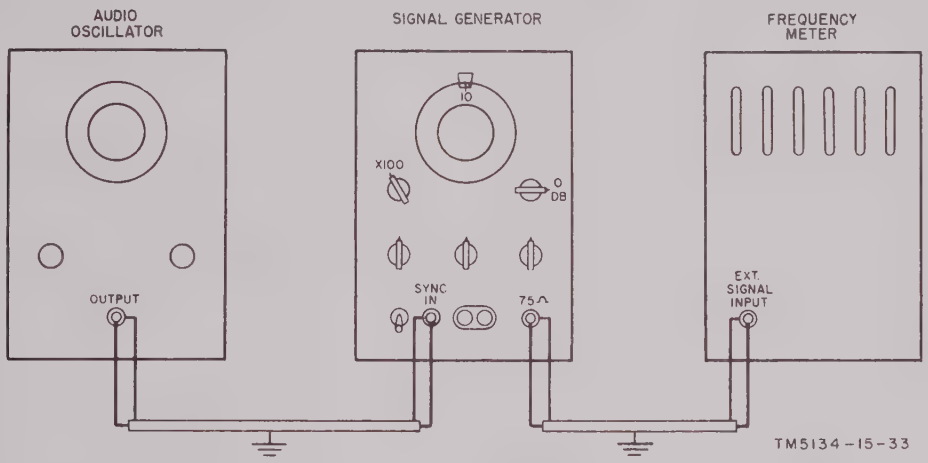


Figure 30. Connections of external synchonization test.

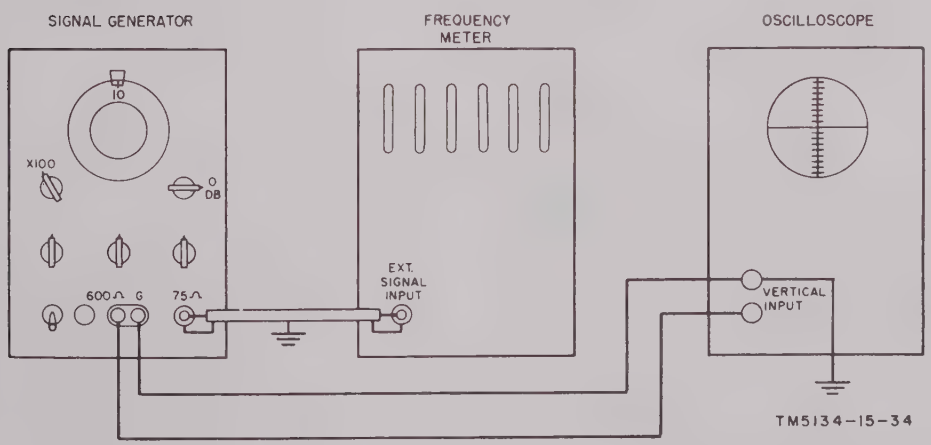


Figure 31. Connections for frequency calibration and range tracking check.

(4) Set the controls on the frequency meter to permit its use for period measurement.

(5) The observed period of 1 complete square-wave cycle must be within the limits shown in the chart below. Correct any range which is out of tolerance by the control specified in the chart below:

RANGE switch	FREQUENCY dial	Period (ms)	Upper limit (millisecond)	Lower limit (millisecond)	Calibration control(fig. 11)
X 1	10	100	111	90.0	R20
X 10	10	10.0	11.1	9.09	R21

g. Output Wave Form. Connect the equipment as shown in figure 32.

Note. For this portion of the final test procedure, the oscilloscope must have provisions for direct connections to the vertical deflection plates and a linear *calibrated* sweep which includes .02 usec per centimeter (cm), ±3 percent. The vertical amplifier must be capable of passing all frequencies from dc to 10 mc and *must* have a *minimum* rise time of .035 usec. Oscilloscope AN/USM–50 does *not* meet all of these specifications.

(1) Be sure that the cable which goes to the vertical deflection plate is connected so that positive excursions of the square wave will deflect the beam upward. To determine which is the positive deflection plate, connect the positive side of a 30-volt battery first to one plate and then to the other. The connection which causes the beam to swing upward is the positive plate.

(2) Operate the controls on the oscilloscope to adjust the horizontal sweep rate of .02 usec per cm.

(3) Set the RANGE control to X 100K and the FREQUENCY control to 10. Observe the leading edge of the square wave and note that the horizontal distance between the 10 percent and 90 percent amplitude points does not exceed 1 cm. (fig. 33).

(4) The rise time of the leading edge of the square wave may be computed in usec by measuring the horizontal distance (in cm) between the 10 percent and 90 percent points of the rise and multiplying this distance by the sweep rate (.02 usec/cm).

Example: Horizontal distance between 10% and 90% points of rise = 2 cm
Sweep rate of oscilloscope
= .02 usec/cm
2 x .02 = .04 usec rise time

(5) The rise time of the 75-ohm output should not exceed .02 usec. If the rise time exceeds this figure, one of the multivibrator tubes, V2 or V3 must be replaced.

(6) Observe the top portion of the square wave and note the precentage of tilt and overshoot. The tilt of the wave crest should not exceed 5 percent of the peak-to-peak value and the overshoot should not exceed 10 percent of peak-to-peak value (figs. 34 and 35).

(7) Remove the cable from the 75-ohm output and make connections to the vertical plates of the oscilloscope from the 600-ohm output as shown in figure 36. Connect the ungrounded side of the 600-ohm output to the positive deflecting plate as described in (1) above.

(8) The rise time of the 600-ohm output should not exceed .1 usec. Adjust the controls on the oscilloscope for the sweep rate of .1 usec per cm and note that the horizontal distance between the 10 percent and 90 percent amplitude points does not exceed 1 cm (fig. 33).

(9) Observe the top portion of the square wave and note the percentage of tilt and overshoot. The tilt of the wave crest should not exceed 5 per cent of the peak-to-peak value and the overshoot should not exceed 10 percent of the peak-to-peak value (figs. 34 and 35).

h. Frequency and Amplitude Variation Test. Connect the vtvm to the 75 Ω output jack and turn the range switch on the vtvm to the 10-volt range.

(1) Adjust the input line voltage of the signal generator to 115 volts ac. Set the RANGE switch to X 100 and the FREQUENCY dial to 10. Set the 75 Ω OUTPUT AMPLITUDE control until the vtvm indicates 3.5 volts rms. Reduce the input line voltage to 105 volts ac and record the vtvm reading. Increase the input line voltage to 125 volts ac and record the vtvm reading. The recorded readings taken at the reduced and increased line voltages must not differ from 3.5 volts rms by more than .07 volts rms.

(2) Connect the 75-ohm output to the input of the frequency meter and adjust the frequency meter so that a frequency of 1,000 cps can be read. Adjust the ac line voltage of the signal

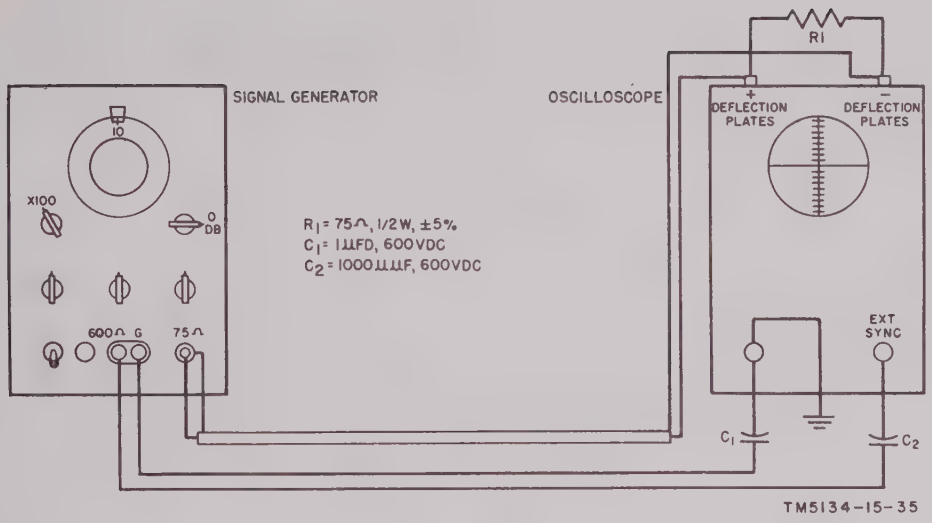


Figure 32. Connections for 75-ohm output wave form test.

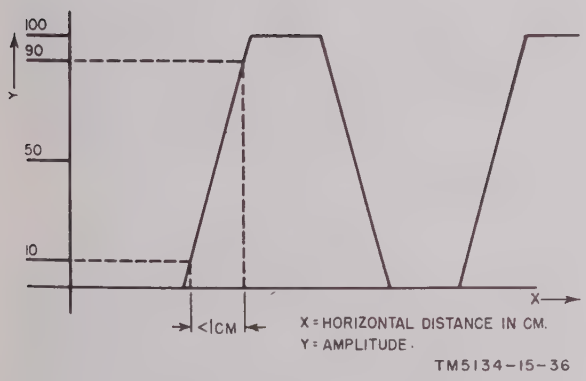


Figure 33. Rise time limit.

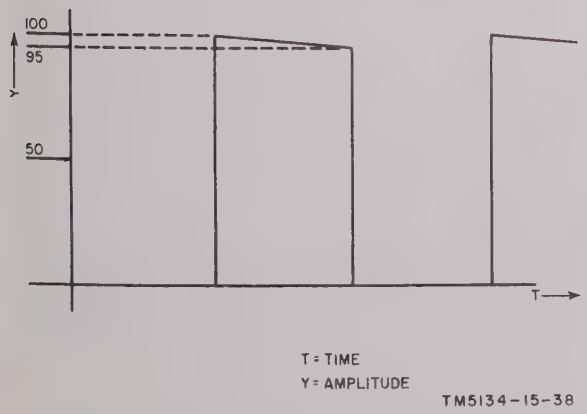


Figure 34. Observation of tilt.

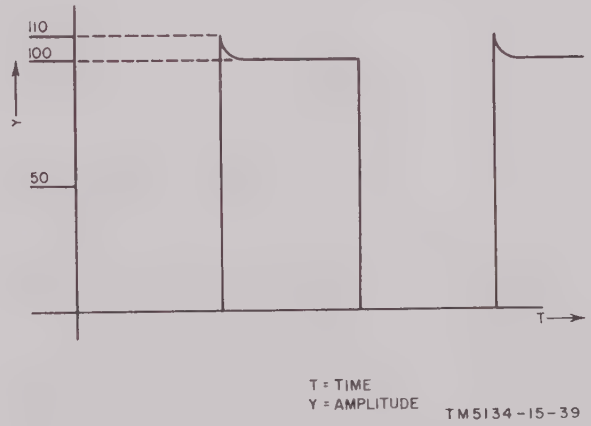


Figure 35. Observation of overshoot.

generator to 115 volts ac. Rotate the FREQUENCY dial until a frequency of exactly 1,000 cps is indicated on the frequency counter. Reduce the input line voltage to 105 volts ac and record the observed frequency. Increase the input line voltage to 125 volts ac and record the observed frequency. The recorded readings must not differ from 1,000 cps by more than 20 cps.

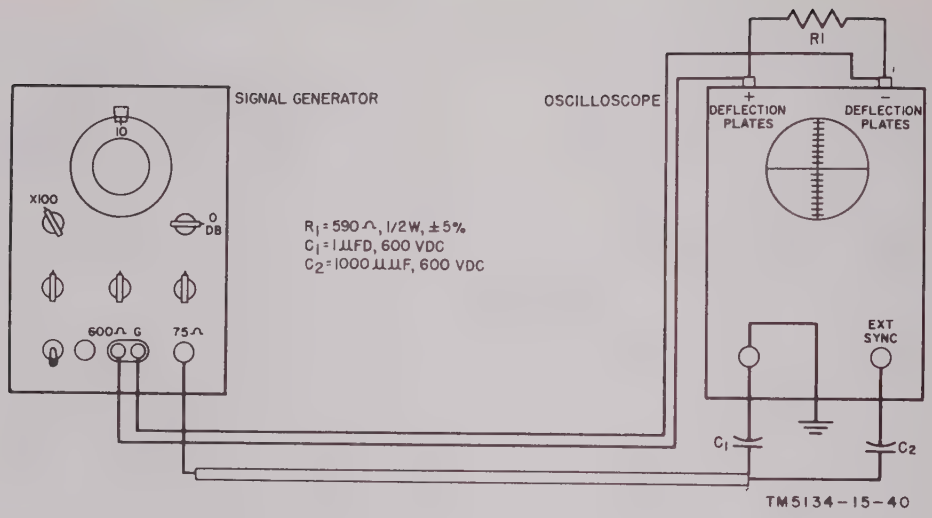


Figure 36. Connection for 600-ohm output wave form tests.

CHAPTER 8

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

52. Disassembly

To prepare the signal generator for transportation and storage, proceed as follows:

a. Remove all cables that connect the signal generator to the power source and to the external synchronization source.

b. Check the equipment against the table of components (par. 5).

53. Repackaging for Shipment or Limited Storage

The exact procedure for repackaging depends on the material available and the conditions under which the equipment is to be shipped or stored. If the original packaging materials are available, use them for repackaging. Figure 2 illustrates one method of repackaging the equipment. Specific directions for repackaging are as follows:

a. Place all the items, listed in the table of components (par. 5), as shown in figure 2.

b. Place a folded corrugated support inside a corrugated fiberboard carton and place the equipment into the carton.

c. Position a corrugated support in each corner of the carton. Seal the carton with gummed tape and place the carton inside another carton containing the moisture-vaporproof barrier.

d. Seal the carton with gummed tape and place this carton inside the box.

e. Nail on the box cover.

f. Staple two metal straps around the sealed box.

Section II. DEMOLITION TO PREVENT ENEMY USE

54. Authority for Demolition

The demolition procedures given in paragraph 55 will be used to prevent the enemy from using or salvaging this equipment. Demolition will be accomplished *only* on the order of the commander.

55. Methods of Destruction

Any or all of the methods of destruction given below may be used. The time available will be the major determining factor for the methods to be used. The tactical situation will also determine the manner in which the destruction order will be carried out. When possible, remove from its case prior to demolition. This will insure maximum destruction in the shortest possible time.

a. Smash. Use sledges, axes, hammers, and similar tools to smash meters, antenna assemblies, tubes, and control panels.

b. Cut. Use axes, machetes, and similar tools to cut wiring, cording, and cabling.

Warning: Be extremely careful with explosives and incendiary devices. Use these items only when the need is urgent.

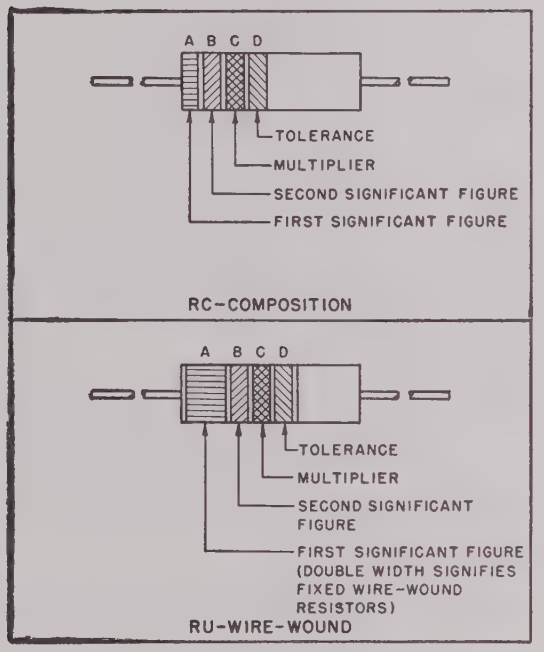
c. Burn. Use gasoline, kerosene, flame throwers, or incendiary grenades to burn cords, cables, spare parts, and literature.

d. Explode. Use firearms, grenades, powder charges, or explosive compounds to demolish equipment where feasible or necessary.

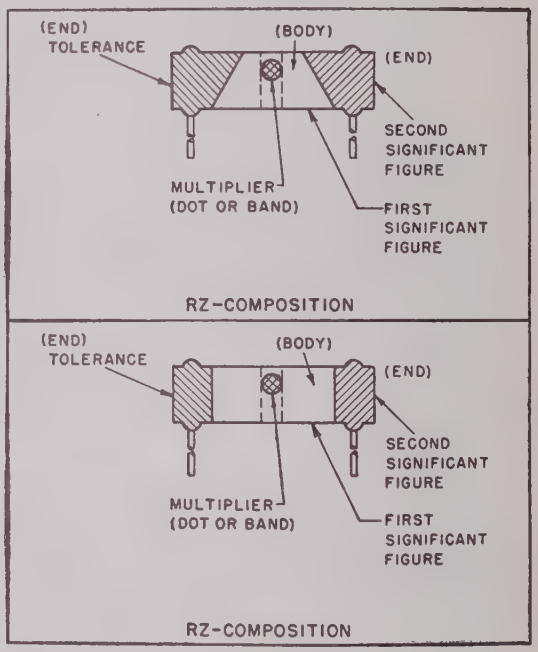
e. Dispose. Scatter or bury destroyed parts or throw them into waterways.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)



RADIAL-LEAD RESISTORS (UNINSULATED)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

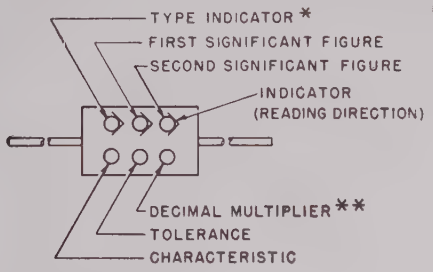
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-RI

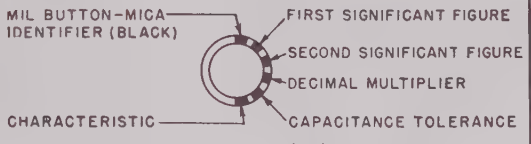
Figure 37. MIL-STD resistor color-code markings.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)

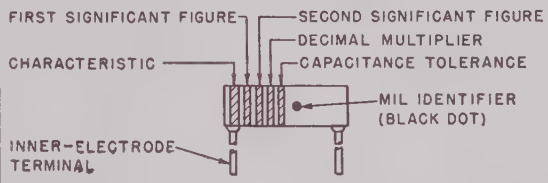


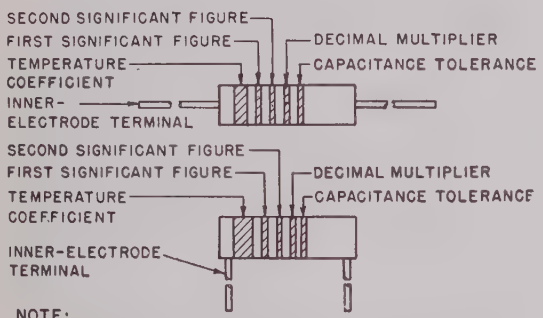
* BLACK DOT: MICA DIELECTRIC
SILVER DOT: PAPER DIELECTRIC
**INDICATES NUMBER OF ZEROS ON PAPER TYPE.

MICA (CM) AND PAPER (CN)



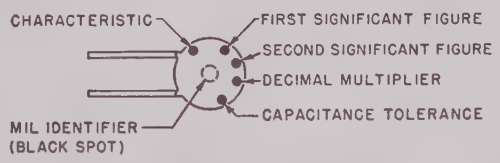
BUTTON-MICA (CB)





NOTE:
SPOTS MAY BE USED INSTEAD OF BANDS; TEMPERATURE COEFFICIENT MARKING IS LARGER.

CERAMIC-TEMPERATURE COMPENSATING (CC)



NOTES:
1. SPOTS MAY BE USED ON TUBULAR CAPACITORS; CHARACTERISTIC SPOT IS LARGER AND MIL IDENTIFIER IS ON SIDE DIAMETRICALLY OPPOSITE COLOR SPOTS.
2. MIL IDENTIFIER OF DISK TYPE IS ON REVERSE SIDE; CHARACTERISTIC SPOT IS LARGER OR SPACE BETWEEN CHARACTERISTIC AND TOLERANCE SPOTS IS THREE TIMES SPACE BETWEEN ADJACENT SPOTS.
3. TOLERANCE: YELLOW, +100%, -20%.

CERAMIC-GENERAL PURPOSE (CK)

CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE [2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500) [3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-C1

Figure 38. MIL-STD capacitor color-code markings.

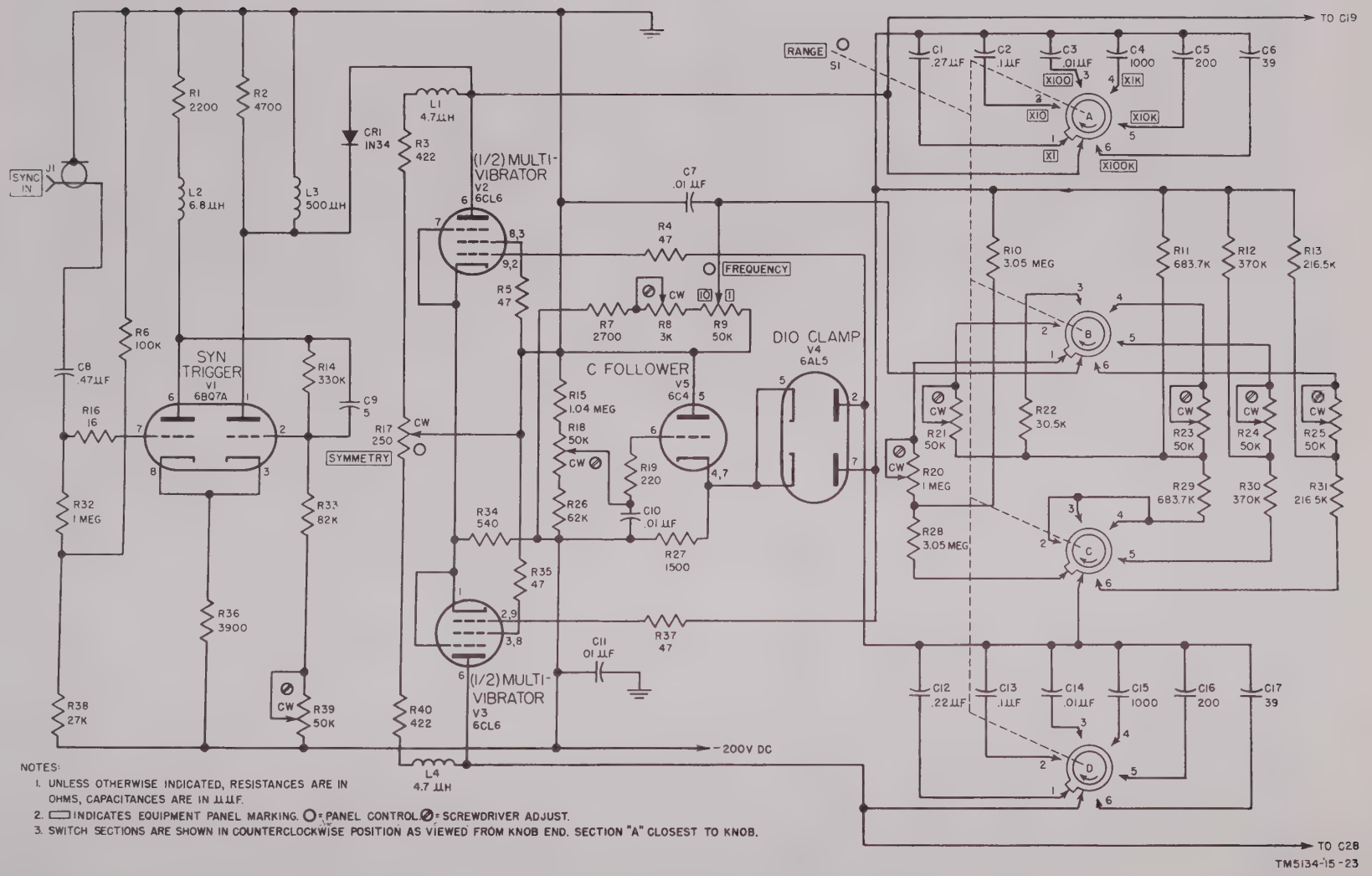


Figure 39. Signal generator, synch trigger, and multivibrator, schematic diagram.

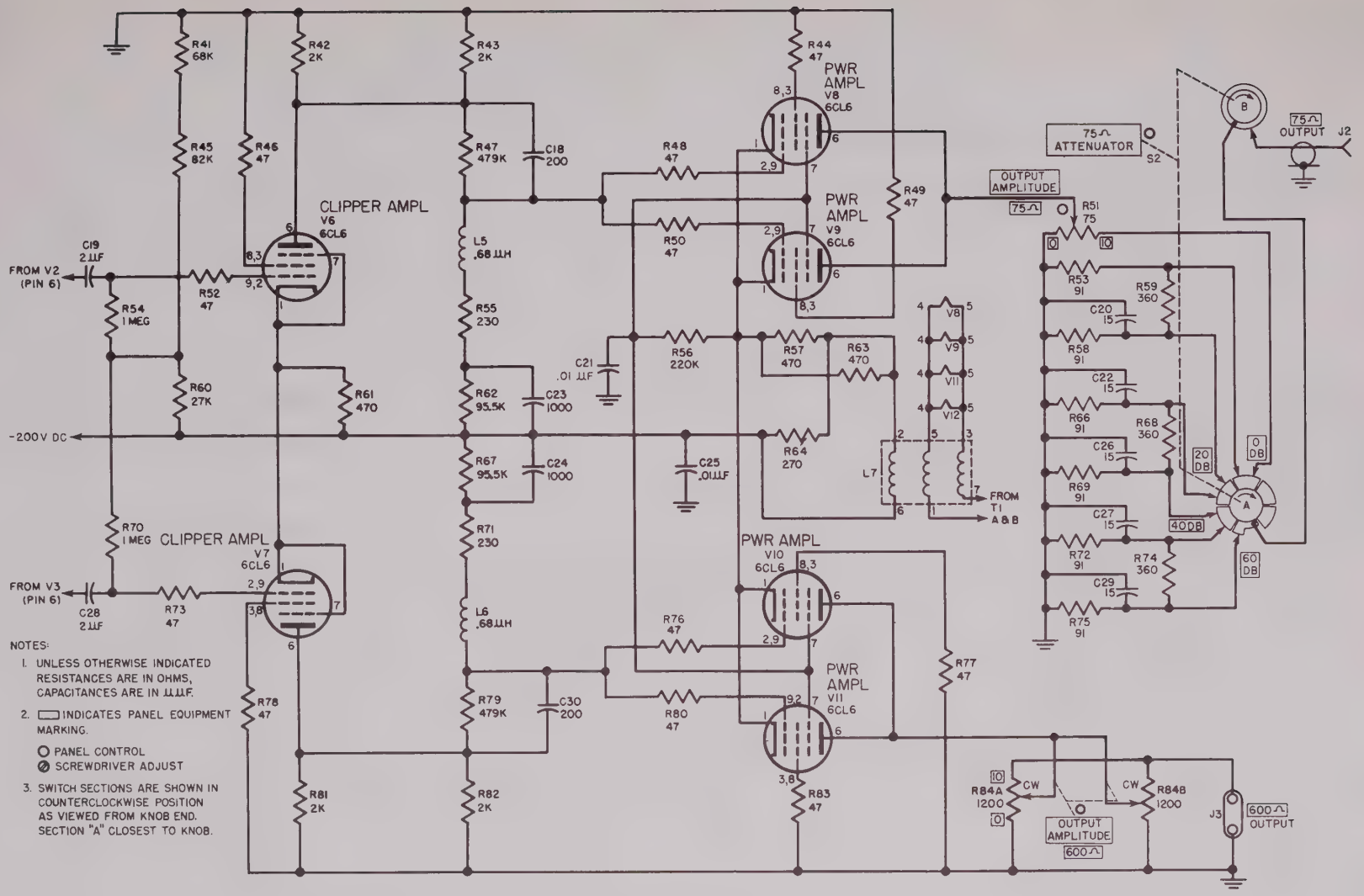


Figure 40. Signal generator, amplifier stages, schematic diagram.

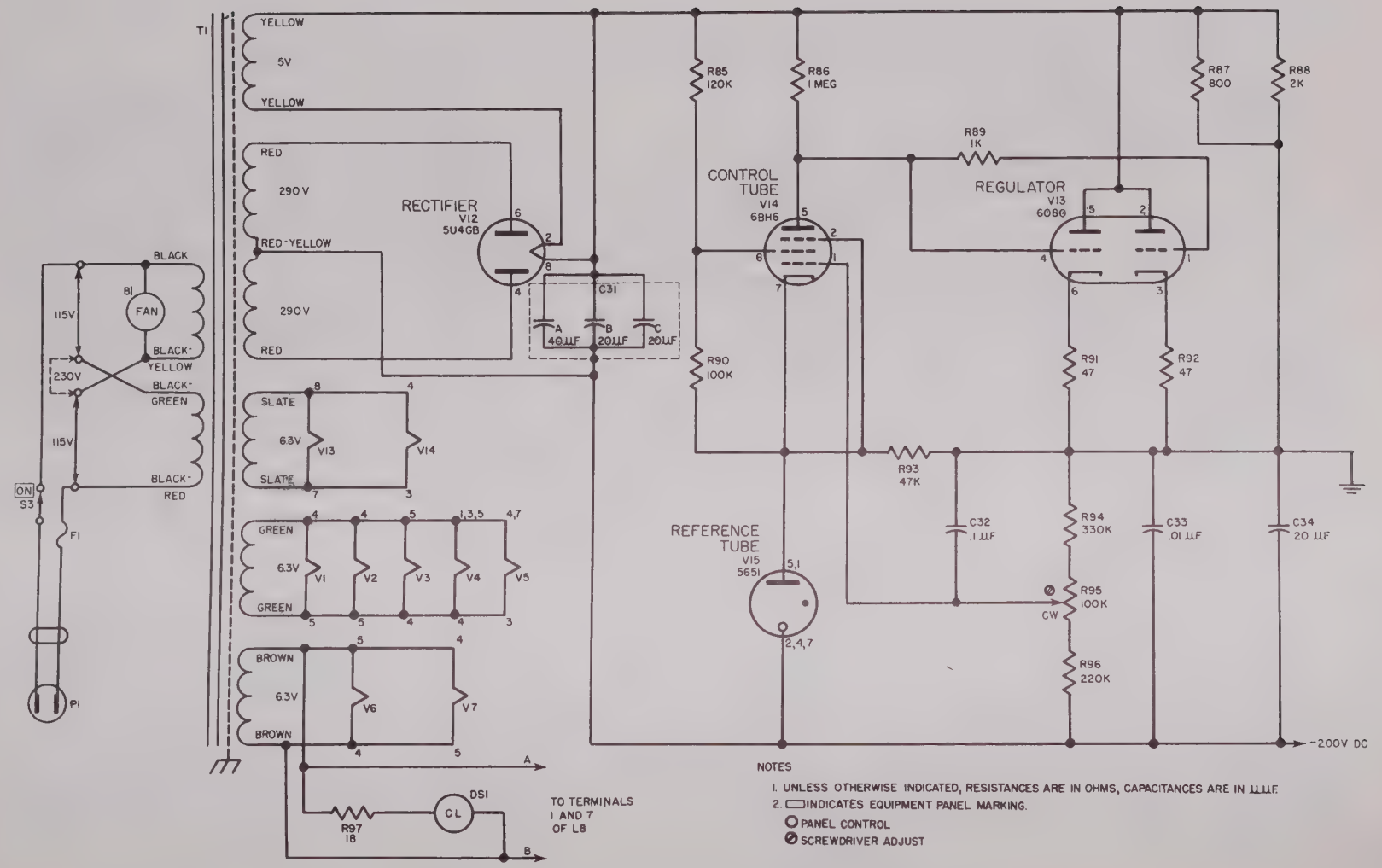


Figure 41. Signal generator, power supply, schematic diagram.

APPENDIX

REFERENCES

The following references are applicable and available to the operator of Signal Generator SG–299/U.

TM 11–2684A	Audio Oscillator TS–382A/U
TM 11–5057	Frequency Meter AN/USM–26
TM 11–2661	Electron Tube Test Set TV–2/U
TM 11–5132	Electronic Voltmeter ME–30B/U
TM 11–5083	Electron Tube Test Set TV7/U

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[AG 412.41 (30 Apr 58)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

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General, United States Army,
Chief of Staff.

Official:

HERBERT M. JONES,
Major General, United States Army,
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AMS (1)
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Trans Terminal Comd (2)
Army Terminals (2)
OS Sup Agcy (2)
USA Sig Pub Agcy (8)
USA Sig Comm Engr Agcy (1)
USA Comm Agcy (2)
TASSA (13), Midwestern Rgn Ofc (1)
USA Sig Eqp Spt Agcy (2)
USA White Sands Sig Agcy (13)
Yuma Test Sta (2)
USA Elct PG (1)
Sig Fld Maint Shops (3)
Sig Lab (5)
Mil Dist (1)
Sectors, USA Corps (Res) (1)
JBUSMC (2)
Units org under fol TOE:
11–7 (2)
11–16 (2)
11–57 (2)
11–127 (2)
11–128 (2)
11–500 (AA–AE) (2)
11–557 (2)
11–587 (2)
11–592 (2)
11–597 (2)

NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1959 O—531082

TECHNICAL MANUAL

SIGNAL GENERATOR SG-299/U AND SG-299A/U

TM 11-5134-15
CHANGES No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *29 October 1958*

TM 11-5134-15, 14 May 1958, is changed as indicated so that the manual also applies to the following equipment:

Nomenclature	*Order No.*
Signal Generator SG-299A/U	39108-PP-58-A3-A3

Change the title of the manual to: **SIGNAL GENERATORS SG-299/U AND SG-299A/U.**

Page 3, chapter 1. Add the following note below the title of chapter 1:

Note. Signal Generator SG-299A/U is similar to Signal Generator SG-299/U. Information in this manual applies to both models unless otherwise specified.

Change "(fig. 3)" to (**fig. 3 or 3.1**) in the following places:

Page 4, paragraph 6*b*, line 2 and paragraph 6*c*, line 2.

Page 7, paragraph 11, heading.

Change "(fig. 10)" to (**fig. 10 or fig. 10.1**) in the following places:

Page 5, paragraph 10*b*, line 3.

Page 18, paragraph 28*b*, last line.

Change "(fig. 11)" to (**fig. 11 or fig. 11.1**) in the following places:

Page 20, paragraph 29*b*, line 4.
Paragraph 29*b*(4), line 1.
Paragraph 29*b*(7), line 1.
Paragraph 29*c*, line 6.

Page 46, paragraph 51*e*(2), last line.

Insert "or fig. 27.1" after "figure 27" in the following places:

Page 36, paragraph 42*c*, line 3 and paragraph 42*g*, under correction column, item 3 last line.

Page 37, paragraph 42*g*, under correction column item 17, last line.

Change "(fig. 27)" to (**fig. 27 or fig. 27.1**) in the following places:

Page 41, paragraph 43*b* and *c*.

Change "(figs. 39, 40, and 41)" to (**figs. 39, 40, and 41 or 41.1**) in the following places:

Page 35, paragraph 41*b*, line 10.

Page 41, paragraph 43*d*.

On the oscilloscope drawing change "HORIZ. IN" to **VERT. IN,** and change "VERT. IN" to: **HORIZ. IN,** in the following places:

Page 22, figure 13.

Page 23, figure 14.

Add "(unlettered model)" at the end of the captions in the following figures:

Page 2, figure 1.
Page 8, figure 3.
Page 16, figure 9.
Page 19, figure 10.
Page 21, figure 11.
Page 33, figure 22.
Page 38, figure 23.
Page 39, figure 24.
Page 40, figure 25.
Page 42, figure 27.

Page 4, paragraph 5.

Add the following note after *a:*

Note. The dimensions of the A model are 13 15/16 inches high, 12 11/16 inches deep, and 9¾ inches wide.

Add the following note after *b:*

Note. Six 2.5-ampere, 250-volt, 3AG fuses are supplied with the A model.

7.1. Differences in Models

(Added)

The A model is similar to the basic model except for the following differences:

a. The A model uses standard wiring (figs. 24.1 and 25.1) instead of printed wiring.

b. The method of converting the signal generator to 230-volt, 60-cycle operation is different (par. 48.1).

c. The tube location on both lower and upper decks is different (fig. 10.1).

d. The location of the calibration controls has been changed (fig. 11.1).

e. The 600 Ω and 75 Ω OUTPUT AMPLITUDE controls have different panel markings (figs. 3 and 3.1).

f. The voltage and resistance values at some of the tube sockets are different (fig. 27.1).

Page 5, paragraph 10*b*, line 7. After "10 screws," add: (or 4 screws in the A model).

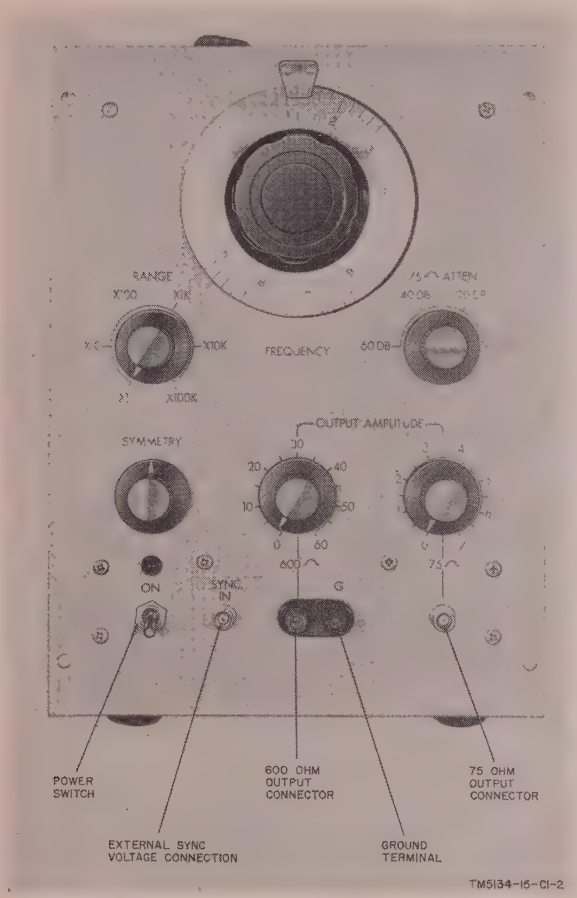

Figure 3.1. (Added) *Signal Generator SG–299A/U, operating controls.*

Page 9, paragraph 14*c*.

(2) (Superseded) When operating from the 75-ohm output into a 75-ohm load, a 75-ohm connecting cable, such as RG–59/U, should be used.

(3) (Superseded) When the signal generator is operating into a load impedance that is lower than 75 ohms the impedance matching network shown in A, figure 5, should be used. With a load impedance of 50 ohms (Z2) and a signal generator output impedance of 75 ohms (Z1), the values of R1 and R2 are determined in the following manner:

$$R1=Z1\sqrt{1-\frac{Z2}{Z1}}$$

$$=75\sqrt{1-\frac{50}{75}}$$

$$=75\sqrt{.33}$$

$$=75+.58 \text{ (approx.)}$$

$$=43 \text{ ohms (approx.)}$$

$$R2=\frac{Z2}{\sqrt{1-\frac{Z2}{Z1}}}$$

$$=\frac{50}{.58}$$

$$=86 \text{ ohms}$$

With these values for R1 and R2 the signal generator works into a load of approximately 75 ohms and the load sees approximately 50 ohms.

(4) (Added) When the signal generator is operating into a load impedance that is higher than 75 ohms the impedance matching network shown in B, figure 5, should be used. With a load impedance of 300 ohms (Z1) and a signal generator output impedance of 75 ohms (Z2), the values of R1 and R2 are determined in the following manner:

Note. The designation Z1 is always assigned to the higher impedance value when this method is used.

$$R1=Z1\sqrt{1-\frac{Z2}{Z1}}$$

$$=300\sqrt{1-\frac{75}{300}}$$

$$=300\sqrt{1-.25}$$

$$=300\sqrt{.75}$$

$$=300+.866$$

$$=260 \text{ ohms (approx.)}$$

$$R2=\frac{Z2}{\sqrt{1-\frac{Z2}{Z1}}}$$

$$=\frac{75}{\sqrt{1-\frac{75}{300}}}$$

$$= \frac{75}{.866}$$

=87 ohms (approx.)

With these values for R1 and R2 the signal generator works into a load of approximately 75 ohms and the load sees approximately 300 ohms.

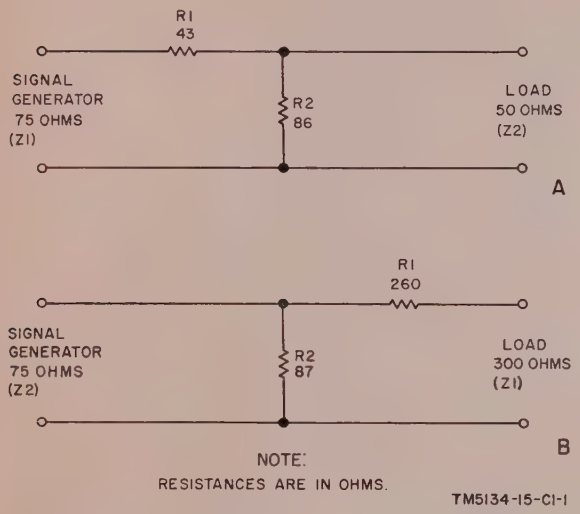

Figure 5. (Superseded) *Impedance matching networks.*

Page 12, paragraph 19*b*(2), line 1. After "10 screws," add: (or 4 screws in the A model).

b(3). Change "(fig. 24)" to: (**fig. 24 or fig. 24.1**).

Page 16, paragraph 23, heading. Add: (Signal Generator SG–299/U Only).

Add the following note below paragraph 23:

Note. The fan motor in the A model requires no lubrication.

Page 18, paragraph 28*b*, line 2. After "10 screws," add: (or 4 screws in the A model).

Page 21, paragraph 29*d*(6), line 5. After "950 cps," add: (850 cps in the A model).

Page 25, figure 15. Add the following:

NOTES:

1. IN THE A MODEL, CR1 IS A TYPE 1N69A.
2. IN THE A MODEL, THE OUTPUT AMPLITUDE CONTROLS ARE GRADUATED FROM 0 THROUGH 60 (600Ω) AND 0 THROUGH 7 (75Ω).

Page 27, figure 16. Add the following to the notes:

4. IN THE A MODEL, R8 IS 5K AND R26 IS 90.5K.

Page 28, figure 17. Add the following to the notes:

4. IN THE A MODEL, C1 IS .22UF.

Page 29, figure 18. Add the following to the notes:

3. IN THE A MODEL CR1 IS A TYPE 1N69A.

Paragraph 35*b*, line 8. After "V7", insert: (Resistor R45 is omitted in the A model, and the value of R41 is increased to 150K ohms).

Page 30, figure 19. Add the following to the note:

2. IN THE A MODEL, R45 IS DELETED AND R41 IS 150K.

Page 31, paragraph 37.

Heading. Change "(fig. 22)" to: (**fig. 22 or fig. 41.1**).

a.1. (Added) In the A model, winding 1–2 is used for 115-volt operation. For 230-volt operation, windings 1–2 and 3–4 are connected in series and the line voltage is applied between 1–4. The fan motor remains connected between winding 1–2.

Page 35, paragraph 41*b*, line 8. Change "(figs. 23–25)" to (**figs. 23–25 and 23.1–25.1**).

Page 36, paragraph 42*d*, line 3. After "through 25," add: (or 23.1–25.1).

e, line 5. After "figure 41," add: (or 41.1).

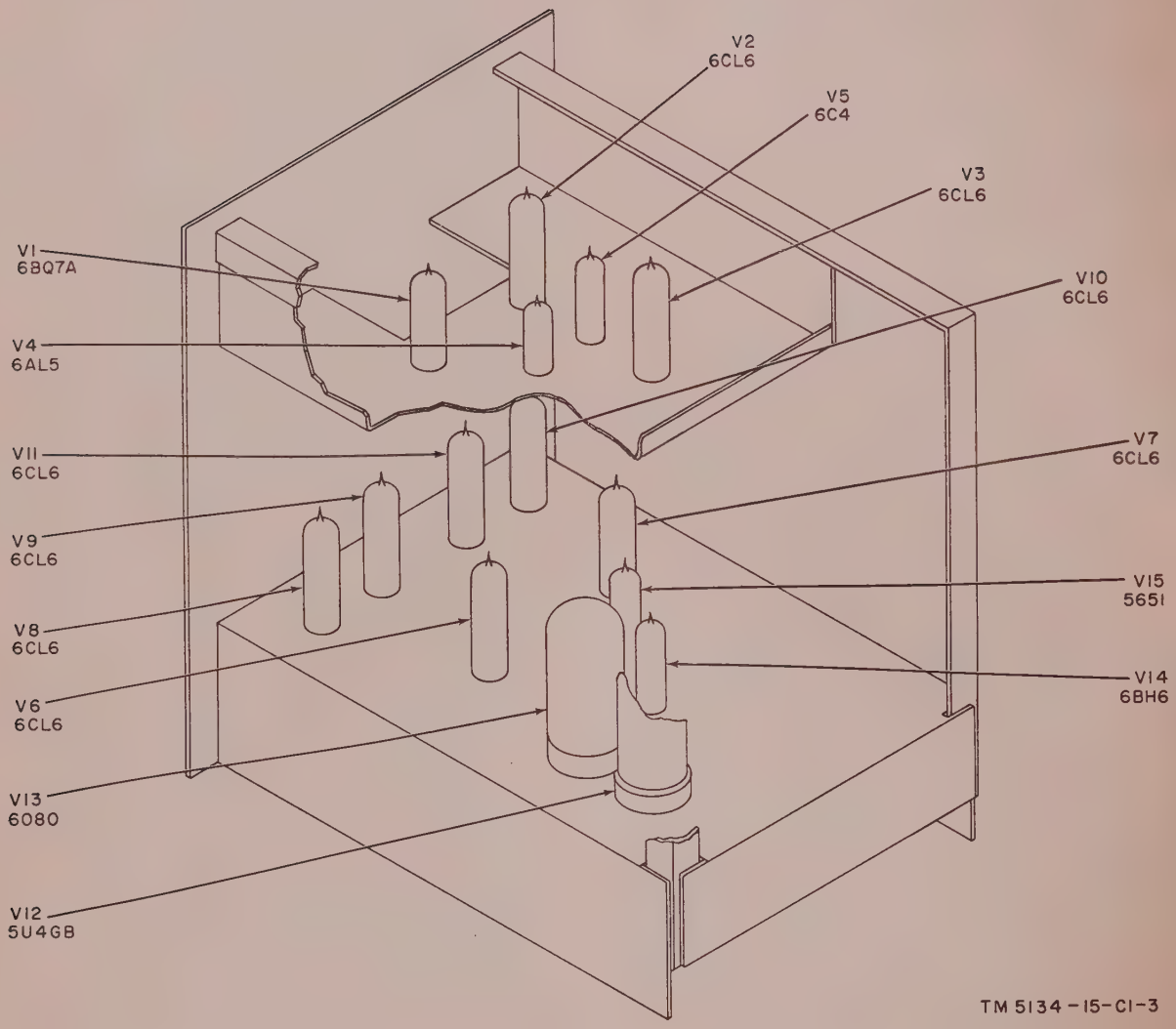

Figure 10.1. (Added) *Tube location diagram, Signal Generator SG–229A/U.*

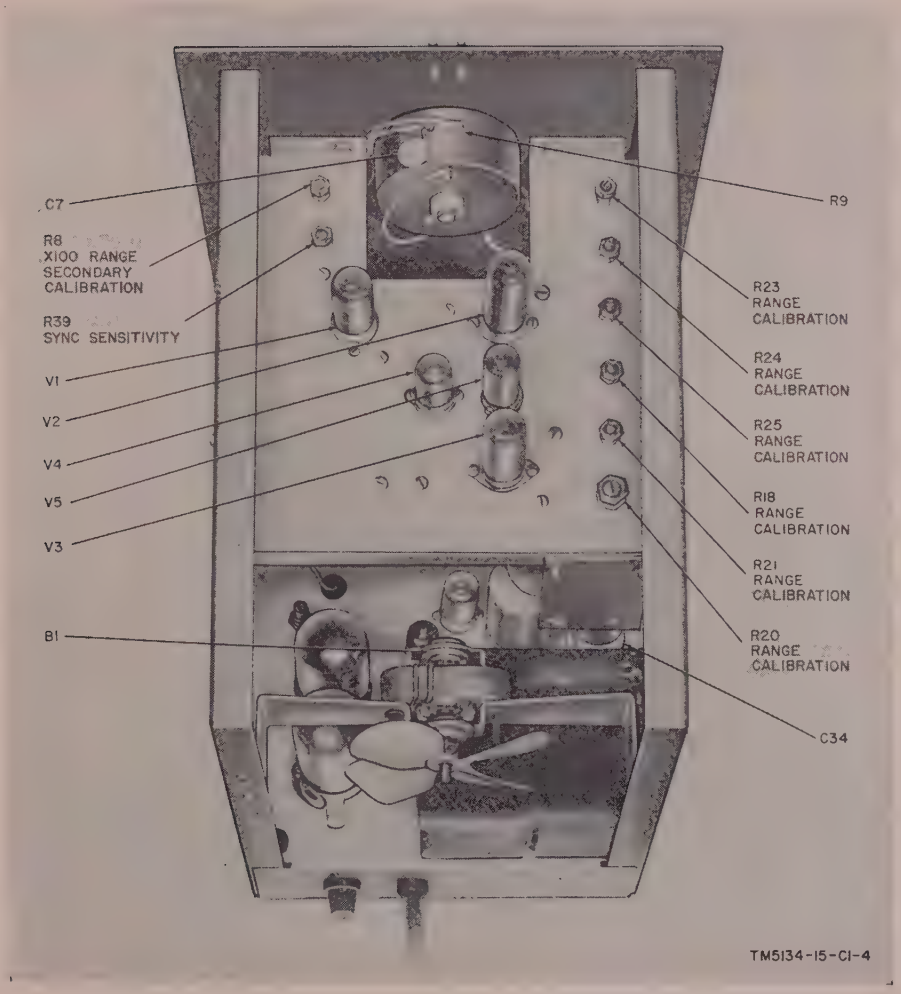

Figure 11.1. (Added) *Signal Generator SG–299A/U, calibration adjustments.*

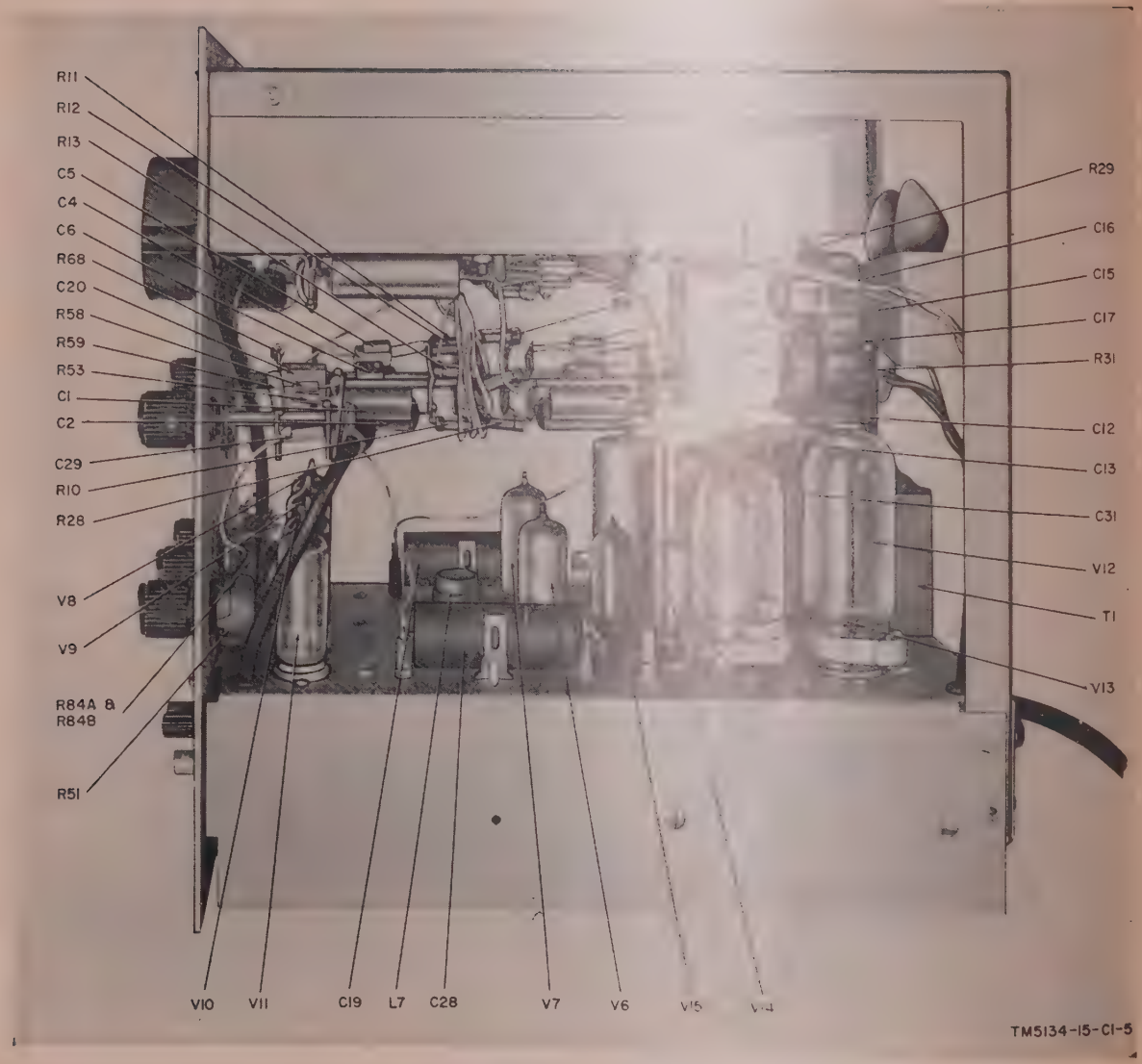

Figure 23.1. (Added) *Signal Generator SG–299A/U, side view, showing location of parts.*

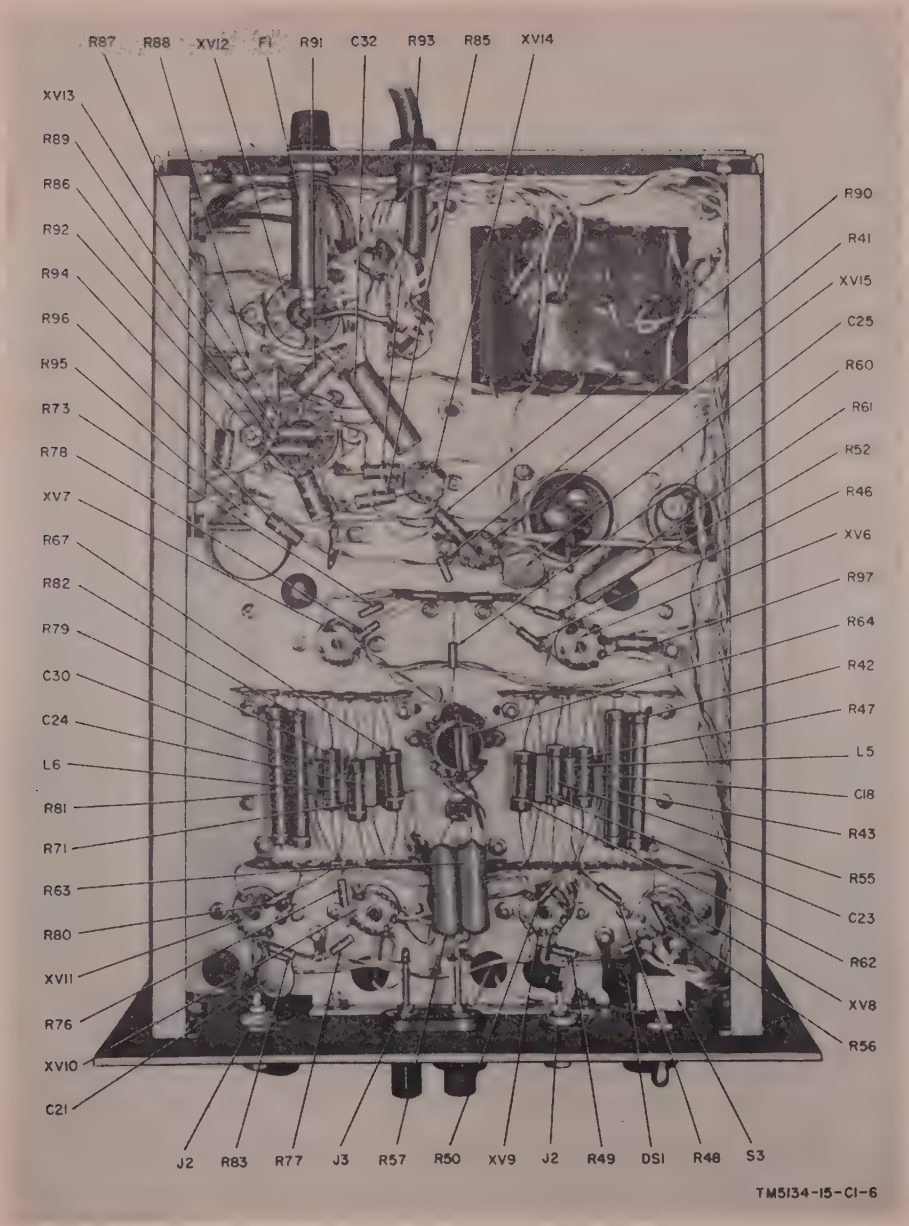

Figure 24.1. (Added) *Signal Generator SG–299A/U, bottom view, showing location of parts.*

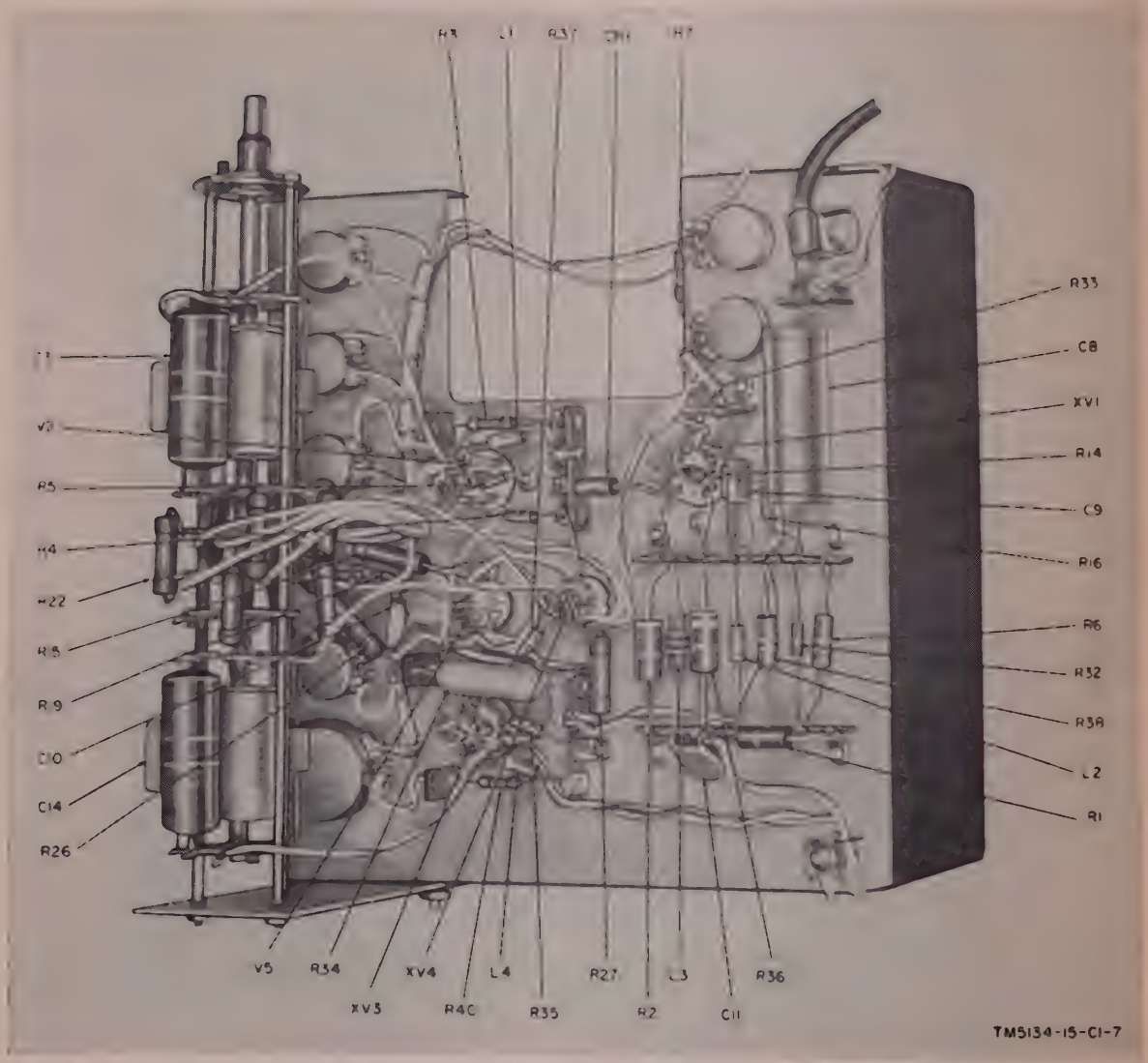

Figure 25 1. (Added) *Sync trigger and multivibrator chassis, Signal Generator SG-299-A/U, bottom view, showing location of parts.*

44.1. Dc Resistance of Transformer and Coils (A Model)

(Added)

The resistances of the transformer windings and the coils in the signal generator are listed below.

Transformer or coil	Terminals or leads	Resistance (ohms)
T1	1 and 2	1.6
	3 and 4	1.6
	5 and 7	30.5
	8 and 9	.04
	10 and 11	.07
	12 and 13	.04
	14 and 15	.07
L1		.2
L2		.4
L3		1.8
L4		.2
L5		.1
L6		.1
L7	1 and 5	.015
	3 and 7	.015
	2 and 6	.06

48.1. Power Transformer Conversion (A Model)

(fig. 41.1) (Added)

The signal generator can be converted for 230-volt, 60-cycle operation as follows:

a. Connect together terminals 2 and 3 of power transformer T1.

b. Unsolder the lead from F1 which is connected to terminal 2 of T1 at the transformer terminal.

c. Solder the free end of this disconnected lead to terminal 4 of T1. Input power can now be applied through plug P1, fuse F1, and switch S3 to terminals 1 and 4 of T1.

d. The fan should remain connected across terminals 1 and 2 of T1.

Page 54, figure 39. Change the value of R16 from 16 to ***1K.***

Add the following to the notes:

4. IN THE A MODEL, CR1 IS TYPE 1N69A, R8 IS 5K, R26 IS 90.5K, AND C1 IS .22 UF.

Page 55, figure 40. Add the following to the notes:

4. IN THE A MODEL, R45 IS DELETED AND R41 IS 150K.

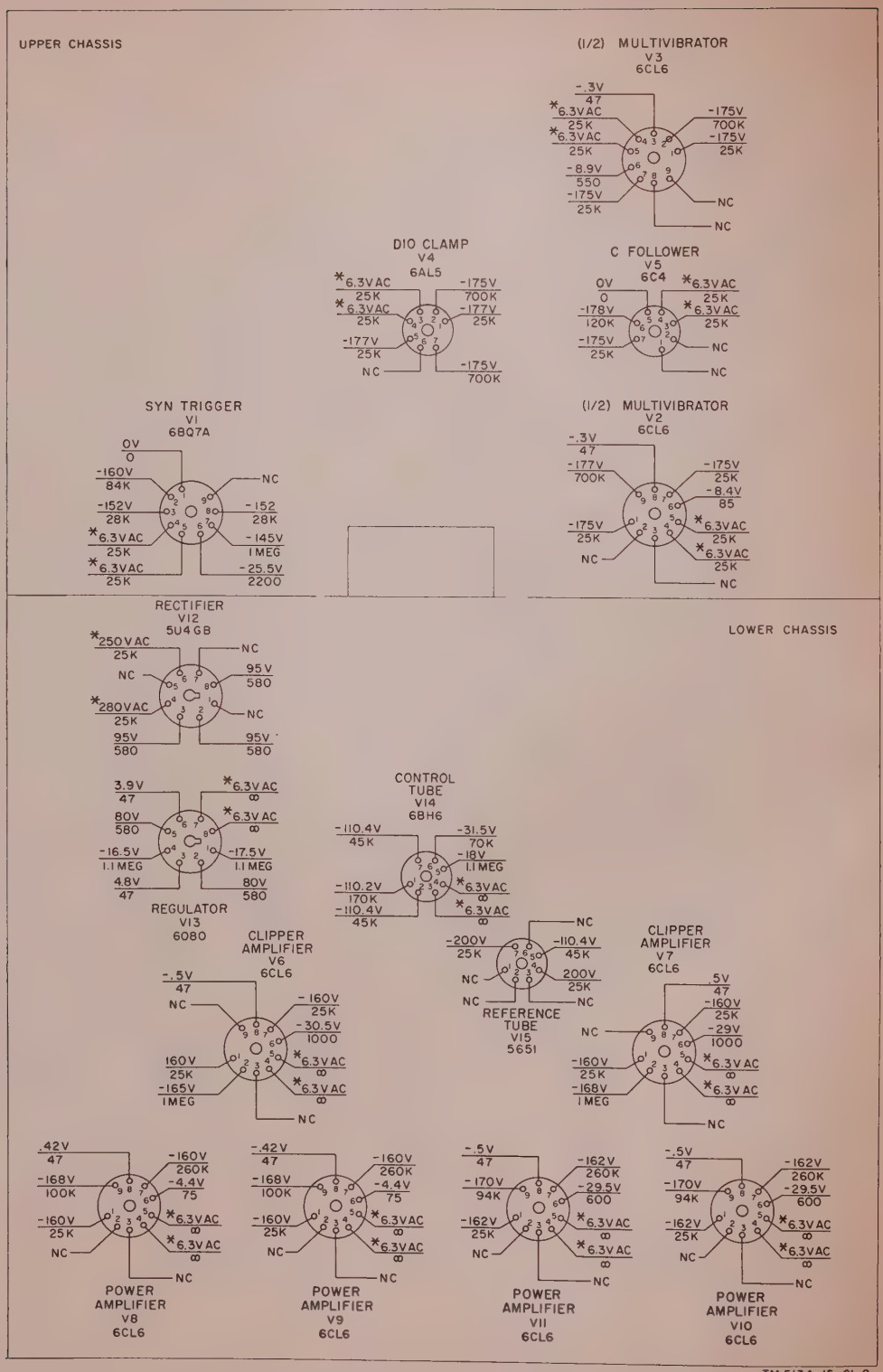

Figure 27.1. (Added) *Tube socket voltage and resistance diagram, Signal Generator SG-299A/U.*

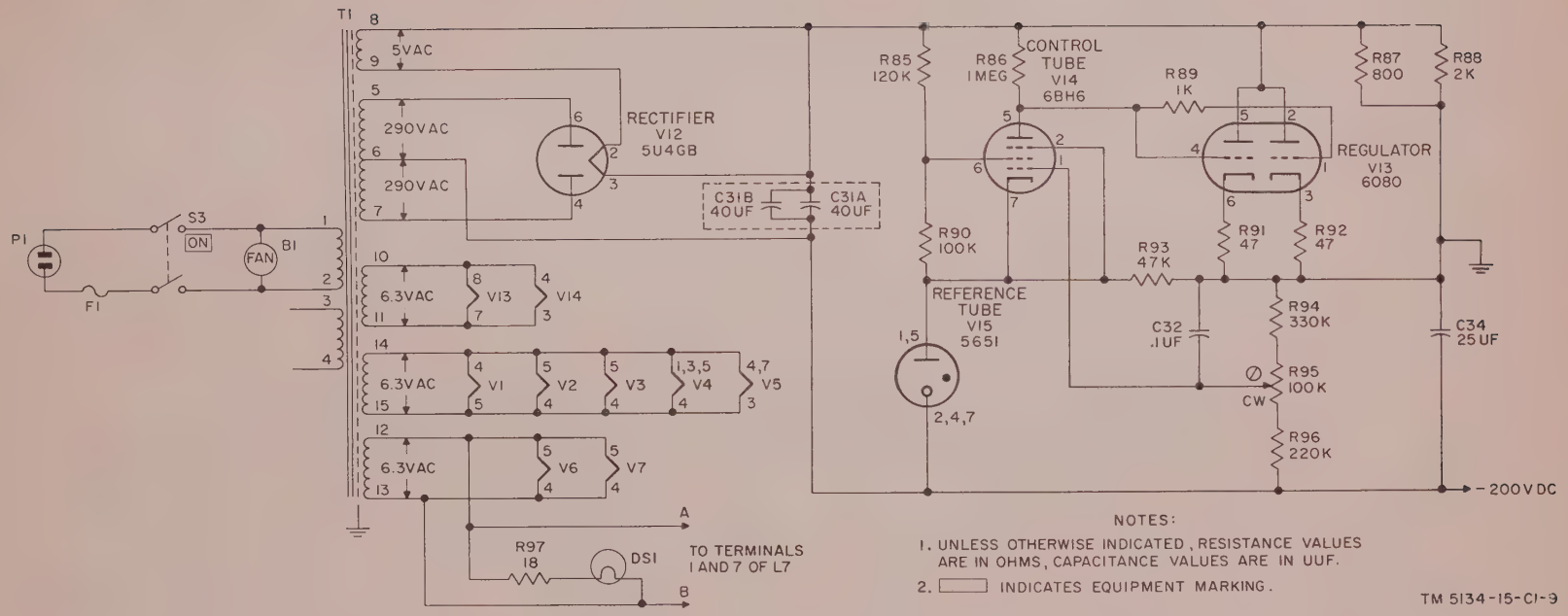

Figure 41.1. (Added) *Signal Generator SG–299A/U, power supply, schematic diagram.*

By Order of *Wilber M. Brucker*, Secretary of the Army:

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Chief of Staff.

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Br Svc Sch (5) except USASCS (25)
Gen Depots (2) except Atlanta Gen Depot (None)
Sig Sec, Gen Depots (10)
Sig Depots (17)
Army Pictorial Cen (2)
Engr Maint Cen (1)
TASSA (15)
Mid-Western Rgn Ofc (TASSA) (1)
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USA Sig Engr Agcy (1)
USA Comm Agcy (2)
USA Sig Eqp Spt Agcy (2)
USA Sig Msl Spt Agcy (13)
WRAMC (1)
AFIP (1)
AMS (1)
Ports of Emb (OS) (2)
Trans Terminal Comd (1)
Army Terminals (1)
OS Sup Agcy (2)
Yuma Test Sta (2)
USA Elct PG (1)
Sig Lab (5)
Sig Fld Maint Shops (3)
Fld Comd, AFSWP (5)
Mil Dist (1)
Sector Comd, USA Corps (Res) (1)
USA Corps (Res) (1)
JBUSMC (2)
Units organized under following TOE's:
11–7 (2)
11–16 (2)
11–57 (2)
11–500 (AA–AE) (2)
11–557 (2)
11–587 (2)
11–592 (2)
11–597 (2)

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

U. S. GOVERNMENT PRINTING OFFICE: 1958

TECHNICAL MANUAL

SIGNAL GENERATORS SG–299/U, SG–299A/U, AND SG–299B/U

TM 11–5134–15
CHANGES No. 2

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *18 December 1959*

TM 11–5134–15, 14 May 1958, is changed as indicated so that the manual also applies to the following equipment:

Nomenclature	*Order No.*	*Serial No.*
Signal Generator SG–299B/U.	3461–PP–59	**1** through 263

Change the title of the manual to: SIGNAL GENERATORS SG–299/U, SG–299A/U, AND SG–299B/U.

Page 3, chapter 1, note (page 1 of C 1). Delete the note and substitute:

Note. Signal Generator SG–299B/U is similar to Signal Generators SG–299/U and SG–299A/U. Information in this manual applies to all three models unless otherwise specified.

Change "(fig. 11 or 11.1)" (as changed by C 1, 29 Oct 58) to (**fig. 11, 11.1, or 11.2**) in the following places:

Page 20, paragraph 29*b*, line 4.
Paragraph 29*b*(4), line 1.
Paragraph 29*b*(7), line 1.
Paragraph 29*c*, line 6.
Page 46, paragraph 51*e*(2), last line.

Add "and SG–299B/U" after "(unlettered model)" (as changed by C 1, 29 Oct 58) at the end of the captions in the following places:

Page 2, figure 1.
Page 16, figure 9.
Page 19, figure 10.
Page 42, figure 27.

Add IN THE A AND B MODEL, THE 600 OHM OUTPUT AMPLITUDE CONTROL IS GRADUATED FROM 0 THROUGH 60, AND THE 75 OHM OUTPUT AMPLITUDE CONTROL IS GRADUATED FROM 0 THROUGH 7 to the notes in the following places:

Page 30, figure 20, as note 3.
Page 55, figure 40, as note 5.

Page 4, paragraph 7.1 heading (page 1 of C 1). Add the following to the heading: (A Model).

7.2. Differences in Models (B Model)
(Added)

The B model is similar to the unlettered model except for the following differences.

a. The B model uses standard wiring (figs. 24.2, 25.2, and 25.3) instead of printed wiring.

b. The method of converting the signal generator to 230-volt, 60-cycle operation is different (par. 48.2).

c. The 600-ohm and the 75-ohm OUTPUT AMPLITUDE controls have same panel markings as A model.

Page 8, figure 3.1 (page 2 of C 1). Delete the caption and substitute:

Signal Generator SG–299A/U and SG–299B/U, operating controls.

Page 9, paragraph 14*c*(3) and (4), (page 2 of C 1). Change the "plus" sign to a **multiplication** sign.

Page 12, paragraph 19*b*(3) (page 3 of C 1) line 1. Change "(fig. 24)" to: (**fig. 24, 24.1, or 24.2**).

Page 16, paragraph 23 (page 3 of C 1) heading. Delete the heading and substitute: Lubrication (Signal Generator SG–299/U and SG–299B/U only).

Page 21, paragraph 29*d*(6) (page 3 of C 1), line 5. Change "A model" to: **A and B models.**

Page 25, figure 15, notes 1 and 2 (page 3 of C 1). After A MODEL, add: AND B MODEL.

Page 27, figure 16, note 4 (page 3 of C 1). After note 4, add the following:

5. IN THE B MODEL, R26 IS 82K.

Page 28, figure 17, note 4 (page 3 of C 1). Delete note 4 and substitute:

4. IN THE A AND B MODEL, C 1 IS .22UF.

Page 29, figure 18, note 3 (page 3 of C 1). After A MODEL, add: AND B MODEL.

Page 31, paragraph 37 (page 3 of C 1). Make the following changes:

Heading. Change "(fig. 22 or fig. 41.1)" to (**fig. 22, 41.1, or 41.2**). Subparagraph *a*, second line from bottom. After "80 μf," add: (unlettered model).

Subparagraph *a.1*. Add subparagraph *a.2* after subparagraph *a.1*:

a.2. In the B model, windings 1–2 and 3–4 are connected in parallel for 115-volt operation. For

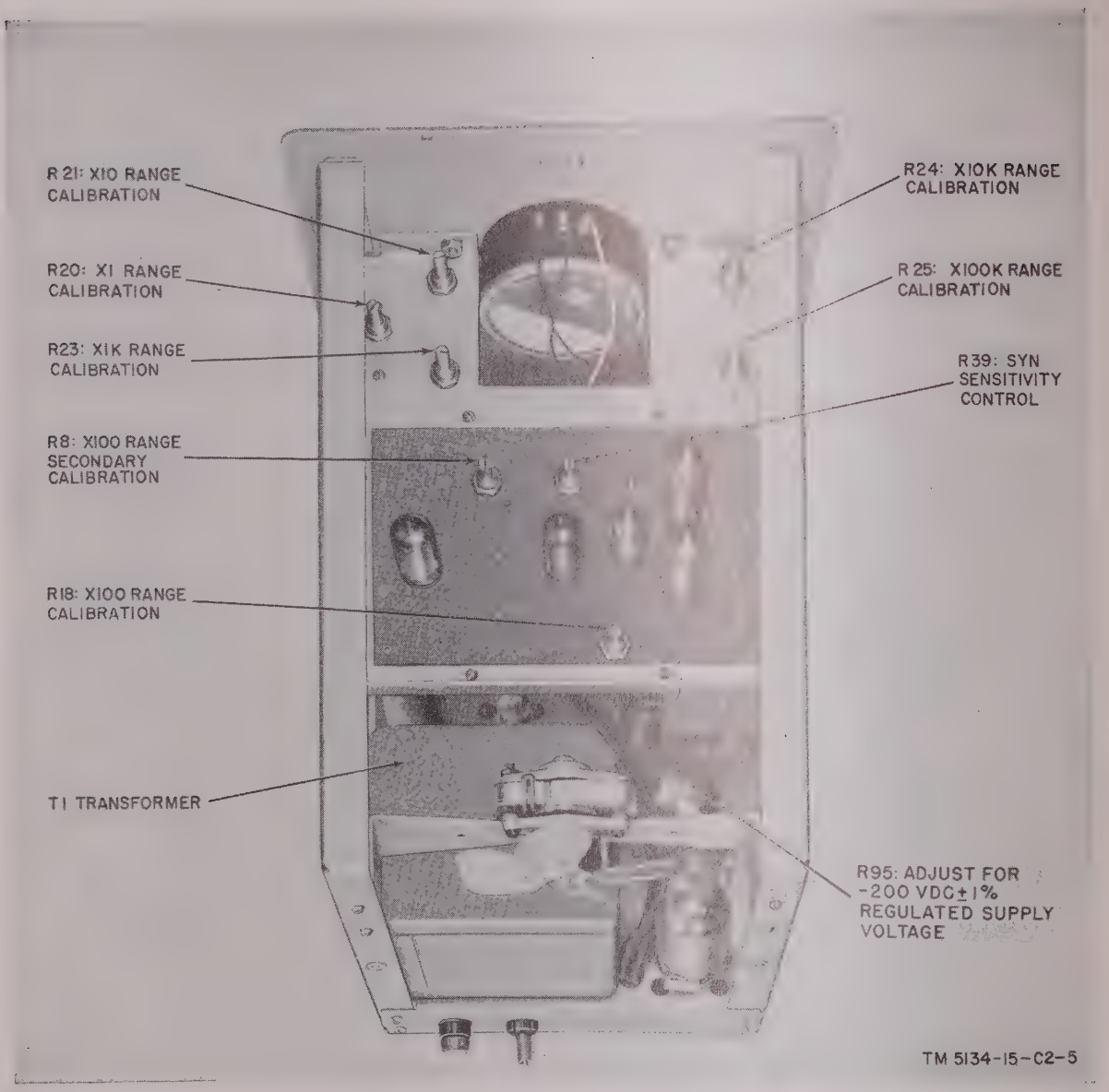
R 21: X10 RANGE CALIBRATION
R20: X1 RANGE CALIBRATION
R23: X1K RANGE CALIBRATION
R8: X100 RANGE SECONDARY CALIBRATION
R18: X100 RANGE CALIBRATION
T1 TRANSFORMER
R24: X10K RANGE CALIBRATION
R 25: X100K RANGE CALIBRATION
R39: SYN SENSITIVITY CONTROL
R95: ADJUST FOR -200 VDC±1% REGULATED SUPPLY VOLTAGE
TM 5134-15-C2-5

Figure 11.2. (Added) *Signal generator SG–299B/U, calibration adjustments.*

230-volt operation, windings 1–2 and 3–4 are connected in series and the line voltage is applied to terminals 1 and 4. Capacitor C31 is a one-section electrolytic capacitor.

Page 33, figure 22. Add the following to the notes:

4. IN THE A MODEL:
   C33 NOT USED.
   C34 IS 25 UF.
   C31 IS A 40–40 UF CAPACITOR.
5. IN THE B MODEL:
   P1 HAS 3 PRONGS, THE THIRD PRONG IS GROUNDED TO CHASSIS.
   S3 and F1 ARE IN THE SAME LINE.
   C31 IS A SINGLE 80–UF CAPACITOR, C34 IS 25 UF.

Page 33, figure 22 (page 1 of C 1). Delete "(*unlettered model*)" from the caption.

Page 35, paragraph 41*b* (page 3 of C 1). Make the following changes:

Line 8. Change the figure reference to: (**fig. 23–25, 23.1, 24.1, and 25.1–25.3**).

Line 10. Change "(figs. 39, 40, and 41 or 41.1)" to: (**fig. 39, 40, 41, 41.1, or 41.2**).

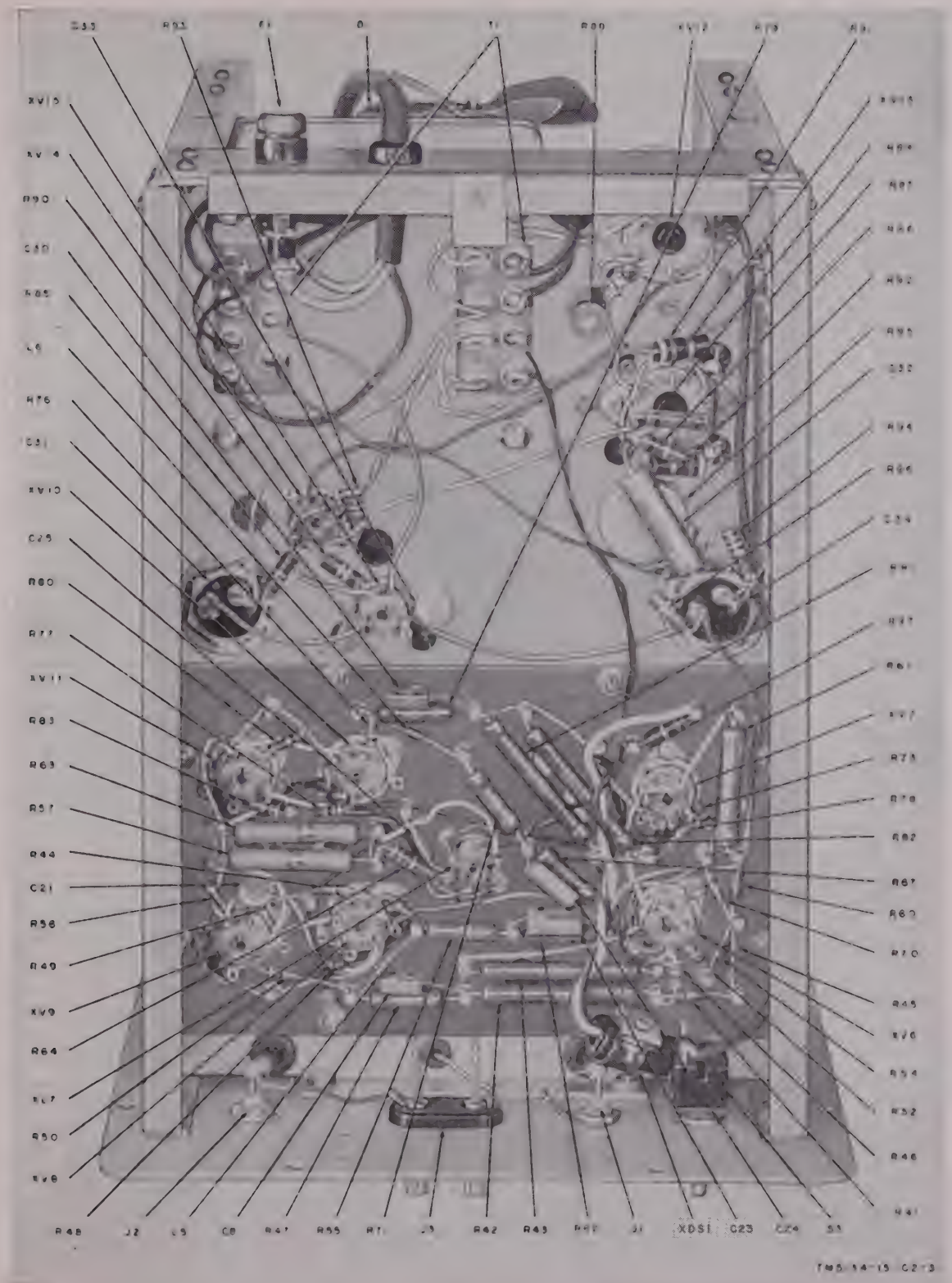

Figure 24.2. (Added) *Signal generator SG–299B/U, bottom view, showing location of parts.*

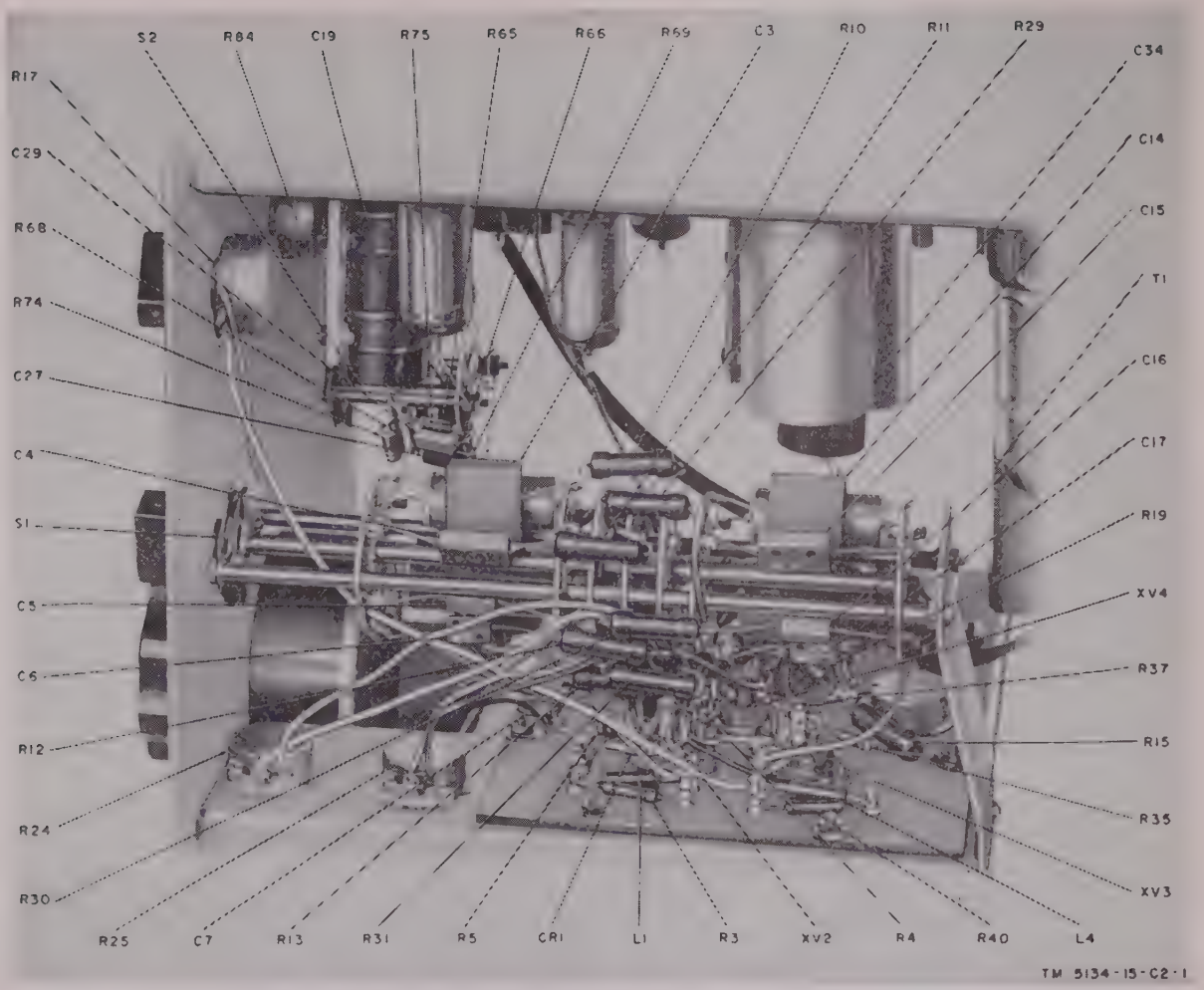

Figure 25.2. (Added) *Signal generator SG–299B/U, sync trigger and multivibrator chassis, left side view, showing location of parts.*

Page 36, paragraph 42 (page 3 of C 1). Make the following changes.

Subparagraph *d*, line 3. Change "(or 23.1–25.1)" to: (**or 23.1–25.3**).

Subparagraph *e*, line 5. Change "figure 41 or 41.1" to: **figure 41, 41.1, or 41.2**.

Page 41, paragraph 43*d* (page 1 of C 1). Change "(fig. 39, 40, and 41 or 41.1)" to: (**figs. 39, 40, 41, 41.1, or 41.2**).

Paragraph 44, heading. Add the following to the heading: (Unlettered Model).

Paragraph 44.1 (page 9 of C 1).

44.2. DC Resistance of Transformers and Coils (B Model)

(Added)

The resistance of the transformer windings and coils in the signal generator are listed below:

Transformer or coil	Terminals or leads	Resistance (ohms)
T1	1–2	1. 4
	3–4	1. 4
	5–7	39. 0
	8–9	0. 065
	10–11	0. 2
	12–13	0. 08
	14–15	0. 04
L1		0. 5
L2		0. 93
L3		1. 85
L4		0. 5
L5		0. 13
L6		0. 13
L7	1–5	0. 015
	3–7	0. 015
	2–6	0. 061

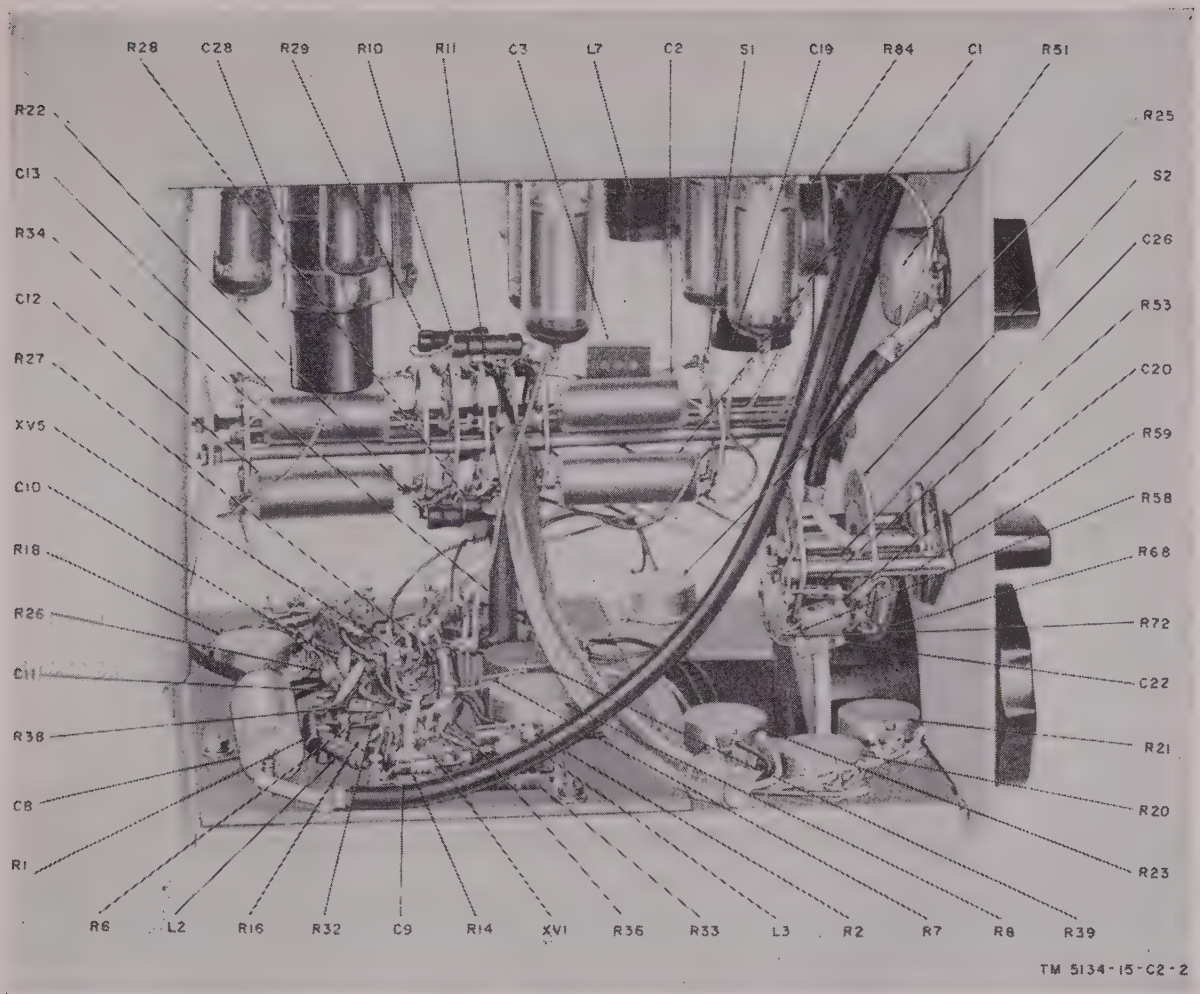

Figure 25.3. (Added) *Signal generator SG–299B/U, sync trigger and multivibrator chassis, right side view, showing location of parts.*

Page 43, paragraph 45, line 2. After "signal generator" add: (unlettered model).

Page 43, paragraph 47*a*(2), chart, Position column. Make the following changes:

Line 5, "75 ohm OUTPUT AMPLITUDE", after "10" add: (7 in the A and B model).

Line 6, "600 ohm OUTPUT AMPLITUDE", after "10" add: (60 in the A and B model).

Page 44, paragraph 48, heading. Below the heading, after (fig. 39), add: (Unlettered Model).

Page 44, paragraph 48.1 (page 9 of C 1).

48.2. Power Transformer Conversion (B Model)

(fig. 41.2) (Added)

The signal generator can be converted for 230-volt, 60-cycle operation as follows:

a. Unsolder the jumper wires from terminals 1 and 3 and 2 and 4 of power transformer T1.

b. Solder one jumper wire between terminals 2 and 3 of power transformer T1.

c. The fan should remain connected across terminals 1 and 2 of power transformer T1.

Page 45, paragraph 51*a*(1), chart, "Position" column. Make the following changes:

Line 5. After "10," add: (7 in the A and B model).

Line 6. After "10," add: (60 in the A and B model).

Page 54, figure 39 (page 9 of C 1). Add the following to the notes:

5. IN THE B MODEL, R26 IS 82 K, CR1 IS 1N69A, C1 IS .22UF.

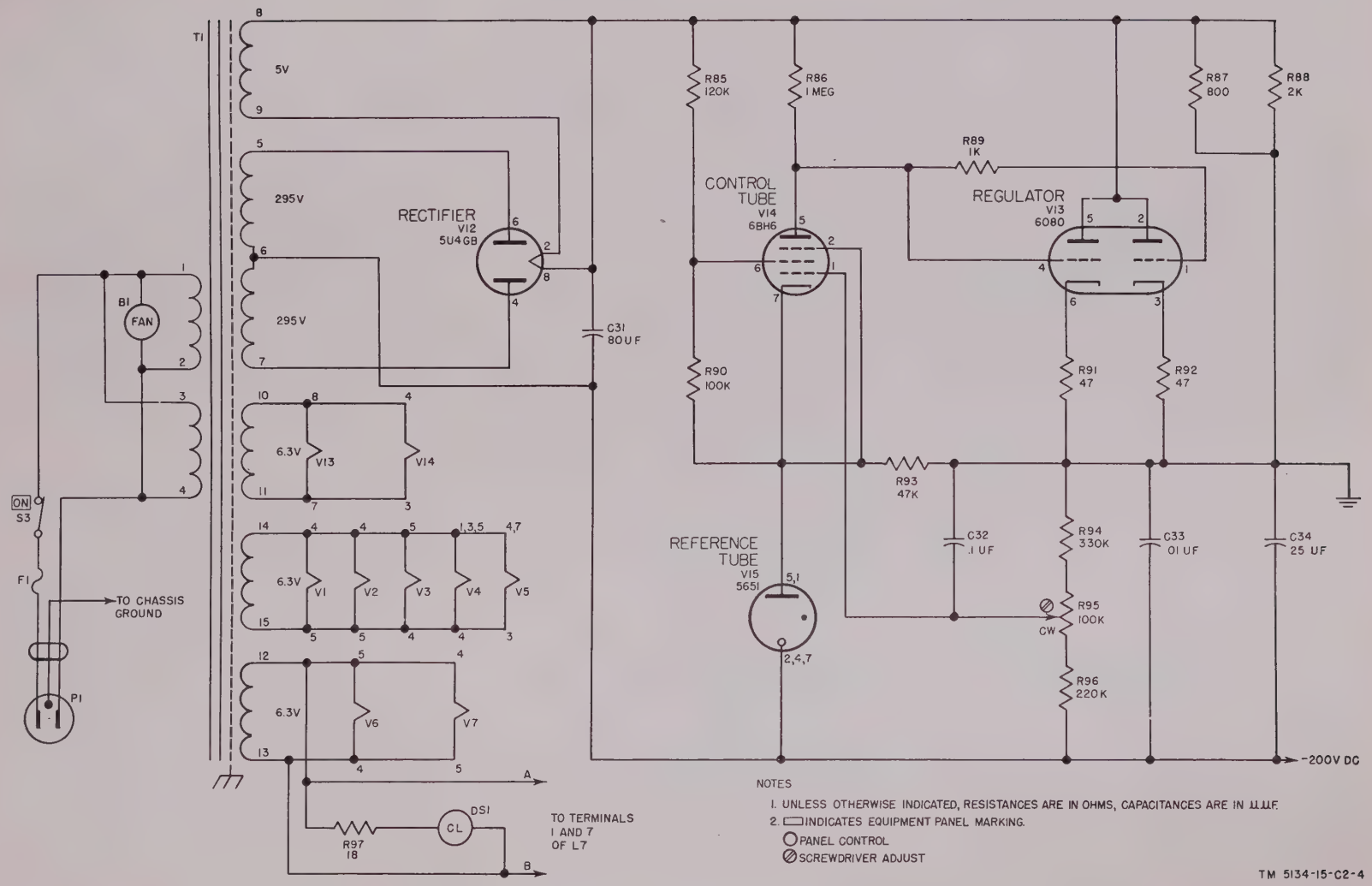

Figure 41.2. (Added) *Signal Generator SG–229B/U, power supply, schematic diagram.*

By Order of *Wilber M. Brucker*, Secretary of the Army:

L. L. LEMNITZER,
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Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General.

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Sig Sec, GENDEP (10)
Sig Dep (17)
Army Pictorial Cen (2)
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USASSAMRO (1)
USA Sig Pub Agcy (8)
USA Sig Engr Agcy (1)
USA Comm Agcy (3)
USA Sig Eqp Spt Agcy (2)
USA Sig Msl Spt Agcy (13)
WRAMC (1)
AFIP (1)
AMS (1)
Ports of Emb (OS) (2)
Trans Terminal Comd (1)
Army Terminals (1)
OS Sup Agcy (1)
Yuma Test Sta (2)
USA Elct PG (1)
Sig Lab (5)
Sig Fld Maint Shops (3)
USA Corps (Res) (1)
JBUSMC (2)
Units organized under following TOE's:
11–7 (2)
11–16 (2)
11–57 (2)
11–98 (2)
11–117 (2)
11–155 (2)
11–500 (AA–AE) (2)
11–557 (2)
11–587 (2)
11–592 (2)
11–597 (2)

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

U.S. GOVERNMENT PRINTING OFFICE: 1959

TECHNICAL MANUAL

SIGNAL GENERATORS SG–299/U, SG–299A/U, AND SG–299B/U

TM 11–5134–15
CHANGES No. 3

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *18 January 1961*

TM 11–5134–15, 14 May 1958, is changed as indicated so that the manual also applies to the following equipment:

Nomenclature	*Order No.*
Signal Generator SG–299A/U	4502–PP–60

Note. The parenthetical reference to previous Changes (example: "page 1 of C 1") indicates that pertinent material was published in that Changes.

Change "(fig. 3 or 3.1)" (page 1 of C 1) to "(fig. 3, 3.1, or 3.2)" in the following places:

Page 4, paragraph 6*b*, line 2.

Paragraph 6*c*, line 2.

Page 7, paragraph 11, heading.

Page 4, paragraph 5*b* (page 1 of C 1). Delete the note and substitute:

Note. Six 2.5-ampere, 250-volt, 3AG fuses are supplied with the A model on Order No. 39108–PP–58 and seven on Order No. 4502–PP–60.

Paragraph 7 (page 1 of C 2). Add paragraph 7.3 after paragraph 7.2.

7.3. Differences in Models (Order No. 4502–PP–60)

The A model supplied on Order No. 4502–PP–60 is similar to the A model supplied on Order No. 39108–PP–58, except for the following differences:

a. The method of converting the signal generator to 230-volt, 60-cycle operation is the same as for the B model (par. 48.2 (page 5 of C 2)).

b. An angle bracket is added to support the rear portion of the chassis above the fan (A, fig. 42).

c. The fan mounting bracket is a single solid bracket (B, fig. 42).

d. The pilot light is relocated (fig. 3.2).

e. An arc with arrowheads on each end is added to the front panel markings above the SYMMETRY control (fig. 3.2).

f. Arrows are added to define the low and high connectors of the OUTPUT AMPLITUDE controls (fig. 3.2).

Page 9, paragraph 14*c* (3) and (4) (page 2 of C 1). Change the plus sign to a multiplication sign.

Page 12, paragraph 19*b*(3) (page 3 of C 1), line 1. Change "(fig. 24)" to: (fig. 24, 24.1, or 24.3).

Page 27, figure 16, note (page 3 of C 1). After note 4, add the following:

5. IN THE A MODEL SUPPLIED ON ORDER NO. 4502–PP–60, R15 IS 1.03 MEGO.

Page 28, figure 17, note (page 3 of C 1). After note 4, add the following:

5. IN THE A MODEL SUPPLIED ON ORDER NO. 4502–PP–60, R11 AND R29 ARE 684K AND R13 AND R31 ARE 216K.

Page 31, paragraph 37*a*.2 (page 1 of C 2). Add subparagraph *a*.3 after subparagraph *a*.2.

a.3. In the A model supplied on Order No. 4502–PP–60, windings 1–2 and 3–4 are connected in parallel for 115-volt operation. For 230-volt operation, windings 1–2 and 3–4 are connected in series and the line voltage is applied to terminals 1 and 4. The fan motor remains connected between winding 1–2. Capacitor C31 is a dual-section electrolytic capacitor, 40 uf each section.

Page 33, figure 22, notes (page 2 of C2). Add notes 6 and 7 after note 5.

6. IN THE A MODEL SUPPLIED ON ORDER NO. 4502–PP–60, C33 IS NOT USED, C34 IS 25 UF, C31 IS A 40–40–UF CAPACITOR, AND S3 IS A DPST SWITCH.

7. IN THE A MODEL SUPPLIED ON ORDER NO. 4502–PP–60, P1 HAS THREE PRONGS; THE THIRD PRONG IS GROUNDED TO THE CHASSIS.

Page 35, paragraph 41*b*, line 8 (page 2 of C 2). Add "24.3" after "24.1".

Page 36, paragraph 42*d*, line 3 (page 3 of C 1), Delete "(or 23.1–25.1)" and substitute: (or 23.1. 24.1, 24.3, and 25.1).

Page 38, figure 23.1 (page 6 of C 1). Change callouts as follows:

From—	*To—*	*From—*	*To—*
V8	V10	V11	V8
V9	V11	C19	C28
V10	V9	C28	C19

Figure 3.2. (Added) *Signal Generator SG–299A/U (Order No. 4502–PP–60), operating controls.*

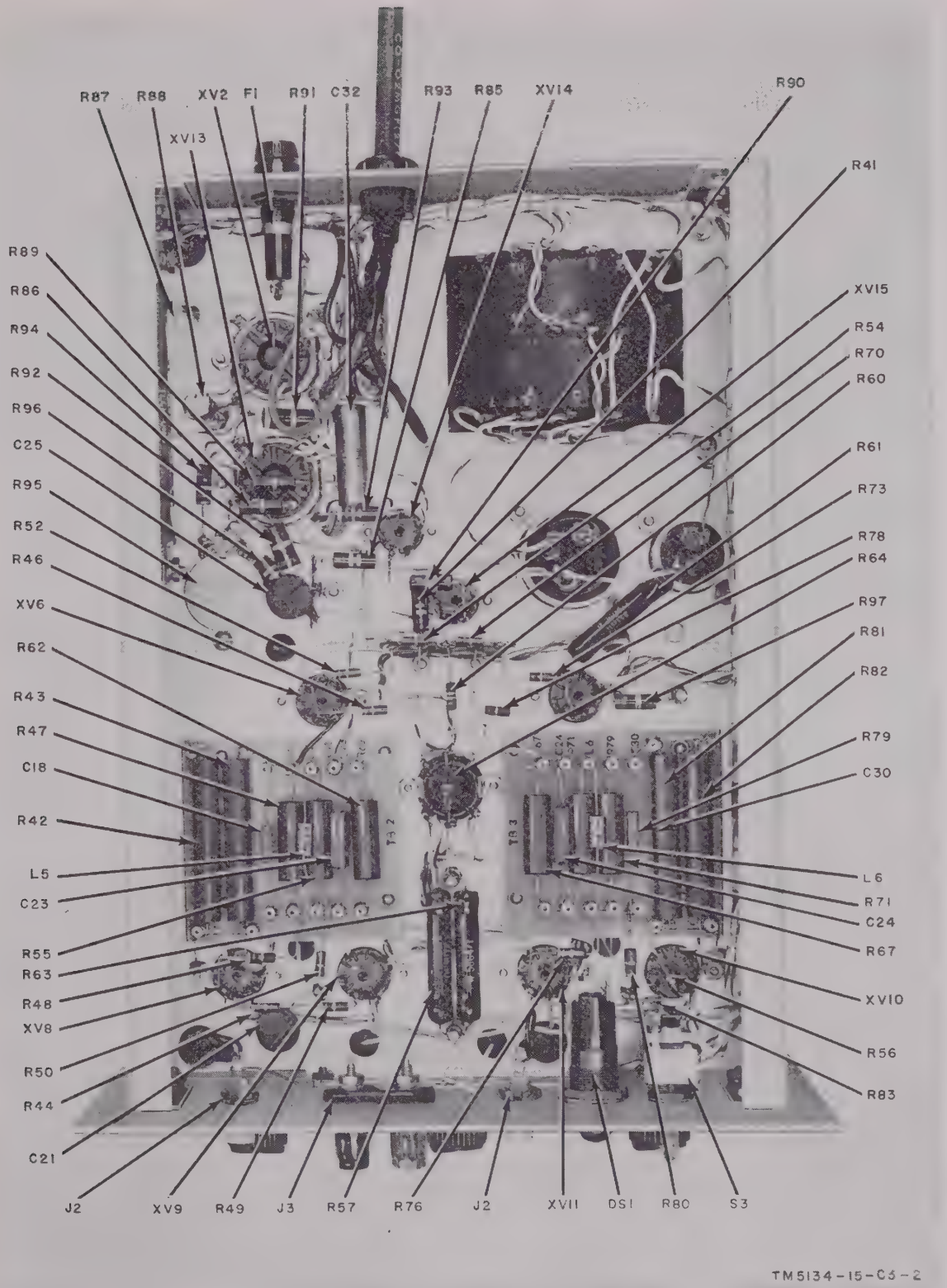

Figure 24.3. (Added) *Signal Generator SG–299A/U (Order No. 4502–PP–60), bottom view, showing location of parts.*

Page 39, figure 24.1 (page 7 of C 1). Change callouts as follows:

From—	To—	From—	To—
XV8	XV10	XV10	XV9
XV9	XV11	XV11	XV8

Page 40, figure 25.1 (page 8 of C 1). Add the following note:

NOTE:

IN THE A MODEL SUPPLIED ON ORDER NO. 4502–PP–60, R6, R32, R38, L2, R1, R36, C11, L3, AND R2 ARE MOUNTED ON COMPONENT MOUNTING BOARD TB1.

Page 43, paragraph 47*a*(2), chart, "Position" column. Make the following changes:

Line 5. After "10," add: (7 in the A model supplied on Order No. 4502–PP–60).

Line 6. After "10," add: (60 in the A model supplied on Order No. 4502–PP–60).

Page 44, paragraph 48, heading. Change "(fig. 39)" to: (fig. 41).

Paragraph 48.2 (page 5 of C 2). Add paragraph 48.3 after paragraph 48.2.

48.3. Power Transformer Conversion (Order No. 4502–PP–60)

Power transformer conversion is accomplished in the A model supplied on Order No. 4502–PP–60 as noted in paragraph 48.2 (page 5 of C 2).

Page 45, paragraph 51*a*(1) chart, "Position" column. Make the following changes:

Line 5. After "10," add: (7 in the A model supplied on Order No. 4502–PP–60).

Line 6. After "10," add: (60 in the A model supplied on Order No. 4502–PP–60).

Page 56, figure 41.1 (page 11 of C 1). Add the following to the notes:

3. IN THE A MODEL SUPPLIED ON ORDER NO. 4502–PP–60, WINDINGS 1–2 AND 3–4 OF T1 ARE CONNECTED IN PARALLEL FOR 115-VOLT OPERATION. FOR 230-VOLT OPERATION, WINDINGS 1–2 AND 3–4 ARE CONNECTED IN SERIES AND THE LINE VOLTAGE IS APPLIED TO TERMINALS 1–4. THE FAN MOTOR REMAINS CONNECTED BETWEEN WINDING 1–2.
4. P1 HAS THREE PRONGS; THE THIRD PRONG IS GROUNDED TO THE CHASSIS.

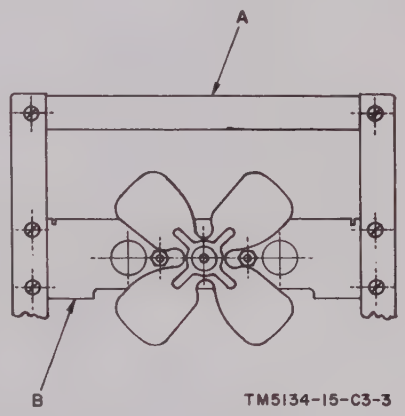

Figure 42. (Added) *Signal Generator SG–299A/U (Order No. 4502–PP–60), showing removable angle bracket.*

By Order of *Wilber M. Brucker*, Secretary of the Army:

G. H. DECKER,
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Chief of Staff.

Official:

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USAR: None.
For explanation of abbreviations used, see AR 320–50.

U.S. GOVERNMENT PRINTING OFFICE: 1961

TECHNICAL MANUAL

SIGNAL GENERATORS SG-299/U, SG-299A/U, AND SG-299B/U

TM 11-5134-15
CHANGES No. 4

HEADQUARTERS,
DEPARTMENT OF THE ARMY,
WASHINGTON 25, D. C., *13 July 1961*

TM 11-5134-15, 14 May 1958, is changed as follows:

Page 3, paragraph 2 . Delete subparagraph *d* and substitute:

d. Parts List Form. Forward DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9) direct to the Commanding Officer, U.S. Army Signal Materiel Support Agency, ATTN: SIGMS-ML, Fort Monmouth, N. J., with comments on parts listings in appendixes II and III.

Page 57. Designate the existing appendix "I" and add the following:

APPENDIX II
MAINTENANCE ALLOCATION
(Added)

1. General

a. This appendix assigns maintenance functions and repair operations to be performed by the lowest appropriate maintenance echelon.

b. Columns in the maintenance allocation chart are as follows:

(1) *Part or component.* This column shows the nomenclature or standard item name. Additional descriptive data are included only where clarification is necessary to identify the part. Components and parts comprising a major end item are listed alphabetically. Assemblies and subassemblies are in alphabetical sequence with their components listed alphabetically immediately below the assembly listing.

(2) *Maintenance function.* This column indicates the various maintenance functions allocated to the echelon capable of performing the operations.

(*a*) *Service.* To clean, to preserve, and to replenish fuel and lubricants.

(*b*) *Adjust.* To regulate periodically to prevent malfunction.

(*c*) *Inspect.* To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.

(*d*) *Test.* To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.

(*e*) *Repair.* To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes but is not limited to, inspecting, cleaning, preserving, adjusting, replacing, welding, riveting, and straightening.

(*f*) *Aline.* To adjust two or more components of an electrical system so

***These changes supersede so much of TM 11-6625-258-12P, 2 July 1959, as pertains to the maintenance allocation chart and first echelon items.**

that their functions are properly synchronized.

(*g*) *Calibrate.* To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.

(*h*) *Overhaul.* To restore an item to completely serviceable condition as prescribed by serviceability standards developed and published by heads of technical services. This is accomplished through employment of the technique of "Inspect and Repair Only as Necessary" (IROAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the item during the overhaul process.

(3) *1st, 2d, 3d, 4th, 5th echelon.* The symbol X indicates the echelon responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the echelon marked by X are authorized to perform the indicated operation.

(4) *Tools required.* This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment referenced. The grouping of codes in this column of the maintenance allocation chart indicates the tool, test, and maintenance equipment required to perform the maintenance function.

(5) *Remarks.* Entries in this column will be utilized when necessary to clarify any of the data cited in the preceding columns.

c. Columns in the allocation of tools for maintenance functions are defined as follows:

(1) *Tools required for maintenance functions.* This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

(2) *1st, 2d, 3d, 4th, and 5th echelon.* The dagger (†) indicates the echelons allocated the facility.

(3) *Tool code.* This column lists the tool code assigned.

(4) *Remarks.* Not used.

2. Mounting Hardware.

The basic entries of the maintenance allocation chart do not include mounting hardware such as screws, nuts, bolts, washers, brackets, clamps, etc.

3. Maintenance by Using Organizations.

When this equipment is used by signal service organizations organic to theater headquarters or communication zones, those maintenance functions allocated up to and including fourth echelon are authorized to the organization operating this equipment.

MAINTENANCE ALLOCATION CHART

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH	(4) 2ND ECH	(5) 3RD ECH	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
SIGNAL GENERATOR SG-299/U, SG-299A/U								
	service				X		5,7,8	
	adjust				X		1,4,5,6,7,8	
	inspect				X		7	
	test				X		1,3,4,5,6,7,8	
	repair		X					2nd echelon repairs to the extent of replacing tubes, fuses, lamps and knobs
	align				X		1,4,5,6,8	
	calibrate				X		1,4,5,6,7,8	
	overhaul					X	1,2,3,4,5,6,7,8	

ALLOCATION OF TOOLS FOR MAINTENANCE FUNCTIONS

(1) TOOLS REQUIRED FOR MAINTENANCE FUNCTIONS	(2) 1ST ECH.	(3) 2ND ECH.	(4) 3RD ECH.	(5) 4TH ECH.	(6) 5TH ECH.	(7) TOOL CODE	(8) REMARKS
SG-299/U, SG-299A/U (continued)							
AUDIO OSCILLATOR TS-382/U				†	†	1	
ELECTRON TUBE TEST SET TV-2/U					†	2	
ELECTRON TUBE TEST SET TV-7/U				†		3	
FREQUENCY METER AN/USM-26				†	†	4	
MULTIMETER AN/URM-105				†	†	5	
OSCILLOSCOPE AN/USM-50				†	†	6	
TOOL EQUIPMENT TE-113				†	†	7	
VOLTMETER, METER ME-30/U				†	†	8	

APPENDIX III
BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

1. General

This appendix lists items supplied for initial operation and for running spares. The list includes tools, accessories, parts, and material issued as part of the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning.

2. Columns

a. Source, Maintenance, and Recoverability Code. Not used.

b. Federal Stock Number. This column lists the 11-digit Federal stock number.

c. Designation by Model. Not used.

d. Description. This column lists the nomenclature or standard item name and brief identifying data for each item. When requisitioning, enter the nomenclature and description.

e. Unit of Issue. Not used.

f. Expendability. Nonexpendable items are indicated by NX.

g. Quantity Authorized. Under "Items Comprising an Operable Equipment," the column lists the quantity of items supplied for the initial operation of the equipment. Under "Running Spares and Accessory Items," the quantities listed are those issued initially with the equipment as spare parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment.

h. Illustrations. Tubes, fuses and lamps are illustrated in figure 43.

Section II. FUNCTIONAL PARTS LIST

(1) SOURCE MAINTENANCE AND RECOVERABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPENDABILITY	(7) QUANTITY AUTHORIZED	(8) ILLUSTRATIONS FIGURE NO	(9) ILLUSTRATIONS ITEM NO
	6625-624-3516		SIGNAL GENERATOR SG-299/U; SG-299A/U					
			ITEMS COMPRISING AN OPERABLE EQUIPMENT					
			SIGNAL GENERATOR SG-299/U; SG-299A/U: 1 cps to 1 mc, 6 bands; ampl continuously var; high impedance 0-55 v min, low impedance 0-7 v peak to peak; output impedance 75 ohm low, 600 ohm high; 115/230 v ±10%, 50-60 cps, 1 ph oper; sync input trigger ckt, 60 db attenuator var in 20 db steps on low output only; bench mtd; steel case 9-3/4 in wd x 13-7/8 in h x 13-3/8 in d		NX			
	Order thru AGC		TECHNICAL MANUAL TM 11-5134-15			2		
			SIGNAL GENERATOR SG-299/U; SG-299A/U: (BASIC COMPONENT)		NX	1		
			RUNNING SPARES AND ACCESSORY ITEMS					
			SIGNAL GENERATOR SG-299/U; SG-299A/U					
	5960-262-3781		ELECTRON TUBE: RETMA type 6BQ7A			1		
	5960-264-2999		ELECTRON TUBE: JAN type 6CL6			3		
	5960-262-0185		ELECTRON TUBE: JAN type 5726/6AL5W			1		
	5960-235-8215		ELECTRON TUBE: JAN type 6C4W			1		
	5960-642-8341		ELECTRON TUBE: RETMA type 5U4GB			1		
	5960-543-1001		ELECTRON TUBE: JAN type 6080WA			1		
	5960-188-3602		ELECTRON TUBE: JAN type 6BH6			1		
	5960-262-0286		ELECTRON TUBE: JAN type 5651WA			1		
	5920-655-3113		FUSE, CARTRIDGE: 2.5 amp, 125 v; one time, non indicating; 1-1/4 in lg x 1/4 in dia; Littelfuse type 3AG			6		
	6240-155-8706		LAMP, INCANDESCENT: 6-8 v, 0.15 amp; miniature bayonet base; clear white bulb; 1-1/8 in h o/a; GE type 47			1		

Figure 43. Signal Generators SG/299/U and SG/299A/U running spares and accessory items.

BY ORDER OF THE SECRETARY OF THE ARMY:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official

R. V. LEE,
Major General, United States Army
The Adjutant General.

Distribution:

Active Army:

DASA (5)
USASA (2)
CNGB (1)
Tech Stf, DA (1) except
CSigO (18)
Tech Stf Bd (1)
USCONARC (5)
USAARTYBD (1)
USAARMBD (2)
USAIB (1)
USARADBD (2)
USAABELCTBD (1)
USAAVNBD (1)
USAATBD (1)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (3)
OS Base Comd (2)
LOGCOMD (2)
MDW (1)
Armies (2)
Corps (5)
USATC Armor (2)
USATC Engr (2)
USATC FA (2)
USATC Inf (2)
USATC AD (2)
Svc Colleges (2)
Br Svc Sch (2)
GENDEP (2) except
Atlanta GENDEP (none)
Sig Sec, GENDEP (5)
Sig Dep (12)
AFSSC (1)
Ft Monmouth (71)
AFIP (1)
WRAMC (1)
Yuma Test Sta (2)
USAEPG (2)
EMC (1)
USACA (3)
USASEA (1)
USA Caribbean Sig Agcy (1)
USA Sig Msl Spt Agcy (13)
USASSA (20)
USASSAMRO (1)
Army Pictorial Cen (2)
USAOMC (3)
USA Trans Tml Comd (1)
Army Tml (1)
POE (1)
OSA (1)
AMS (1)
Sig Fld Maint Shops (3)
JBUSMC (2)

Units organized under following TOE:
11-7 (2)
11-16 (2)
11-55 (2)
11-56 (2)
11-57 (2)
11-97 (2)
11-98 (2)
11-117 (2)
11-155 (2)
11-500 (AA-AE) (RS,RT) (4)
11-557 (2)
11-587 (2)
11-592 (2)
11-597 (2)
17 (2)

NG: State AG (3); Units—Same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320-50.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1961—610789/151

TECHNICAL MANUAL

SIGNAL GENERATORS SG–299/U, SG–299A/U, SG–299B/U, AND SG–299C/U

TM 11–5134–15
CHANGES No. 6

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *25 July 1963*

TM 11–5134–15, 14 May 1958, is changed as indicated so that the manual also applies to the following equipment:

Nomenclature	*Order No.*
Signal Generator SG–299C/U	15865–PP–62

Change the title of the manual as shown above.

Note. The parenthetical reference to previous changes (example: "page 1 of C 2") indicates that pertinent material was published in that changes.

Page 3. Make the following changes:

Chapter 1, note (page 1 of C 2). Delete the note and substitute—

Note. Signal Generator SG–299C/U is similar to Signal Generators SG–299/U, SG–299A/U, and SG–299B/U. Information in this manual applies to all four models unless otherwise specified.

Delete section I (as changed by C 5, 24 Sept 62) and substitute—

Section I. GENERAL

1. Scope

This manual describes Signal Generators SG–299/U, SG–299A/U, SG–299B/U, and SG–299C/U and covers their installation, operation, and operator's, organizational, field, and depot maintenance. It includes operation under usual conditions, cleaning and inspection of the equipment, and replacement of parts available to all echelons.

2. Index of Publications

Refer to the latest issue of DA PAM 310–4 to determine whether there are new editions, changes, or additional publications pertaining to your equipment. DA Pam 310–4 is an index of current technical manuals, technical bulletins, supply bulletins, lubrications orders, and modification work orders that are available through publications supply channels. The index lists the individual parts (–10, –20, –35P etc.) and the latest changes to and revisions of each equipment publication.

2.1. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38–750.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700–58 (Army), NAVSANDA Publication 378 (Navy), and AFR 71–4 (Air Force).

c. Comments on Manual. Forward all comments on this publication direct to: Commanding Officer, U.S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, N. J. DA Form 1598 (Record of Comments on Publications), DA Form 2496 (Disposition Form), or letter may be used.

Page 4, paragraph 7.3 (page 1 of C 3) add paragraph 7.4 after paragraph 7.3.

7.4. Differences in Models (C Model)

The C model is similar to the B model except for the addition of a dual .1-μf, 250-volt ac, 5-ampere capacitor in series with the ac powerline (fig. 41.3).

Page 5. Delete paragraph 9 and substitute—

9. Checking Unpacked Equipment

a. Inspect the equipment for damage that may have been incurred during shipment. If the equipment has been damaged, refer to paragraph 2.1*b*.

*These changes supersede changes No. 5, 24 September 1962.

b. Check the equipment against the packing list. If no packing list accompanies the equipment, use the basic issue items list (appx. III) and report any overages or shortages on DD Form 6 (par. 2.1*b*).

Note. Shortages of spares that do not affect the proper functioning of the equipment should not prevent use of the end item of equipment.

c. If the equipment has been used or reconditioned, see whether it has been changed by a modification work order (MWO). If modified, an MWO number will appear on the front panel near the nomenclature plate. Check to see whether the MWO number and appropriate notations concerning the modification have been annotated in this manual.

Note. Current MWO's applicable to the equipment are listed in DA Pam 310–4.

Page 11. Make the following changes.

Delete paragraphs 16 and 17 and substitute—

16. Scope of Operator's Maintenance

The maintenance duties assigned to the operator of Signal Generators SG–299/U, SG–299A/U, SG–299B/U, and SG–299C/U are listed below together with a reference to the paragraphs covering the specific maintenance functions. The duties assigned do not require tools or test equipment other than those issued with the set.

a. Daily preventive maintenance checks and services (par. 17.2).

b. Weekly preventive maintenance checks and services (par. 17.3).

c. Cleaning (par. 17.4).

d. Replacement of fuse (par. 19).

e. Replacement of pilot lamp (par. 19).

17. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 17.1 through 17.4 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (pars. 17.2 and 17.3) outline functions to be performed at specific intervals. These checks and services are to maintain Army electronic equipment in a combat serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and what the normal conditions are; the *References* column lists the illustrations, paragraphs, or manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by the operator, higher echelon maintenance or repair is required. Records and reports of those checks and services must be made in accordance with the requirements set forth in TM 38–750.

Add paragraph 17.1 through 17.4 after paragraph 17.

17.1. Preventive Maintenance Checks and Services Periods

Preventive maintenance checks and services of Signal Generators SG–299/U, SG–299A/U, SG–299B/U, and SG–299C/U are required daily and weekly. Paragraph 17.2 and 17.3 specify the items to be checked and serviced. In addition to the routine daily and weekly checks and services, the equipment should be rechecked and serviced immediately before going on a mission and as soon after completion of the mission as possible.

17.2. Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Exterior surfaces	Remove dirt and moisture from exposed surfaces of housing and control panel.	Par. 17.4.
2	Switches, knobs, jacks, and connectors.	Inspect switches, knobs, jacks, and connectors for excessive looseness.	
3	Controls	While making the operating check (item 5), observe that the mechanical action of each knob, dial, and switch is smooth and free of external or internal binding.	
4	Pilot lamp	During operation (item 5), check for burned-out pilot lamp.	Par. 19.
5	Operation	Operate the equipment according to paragraph 18	Par. 18.

17.3. Weekly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedu..	References
1	Cord	Inspect power cord for cuts, cracks, strain, fraying, or deterioration.	
2	Handle	Hand-check for looseness of the handle.	
3	Preservation	Inspect exposed metal surfaces for rust and corrosion. If present, refer to higher echelon for repair.	

17.4. Cleaning

Inspect the exterior of the signal generator. Exterior surfaces should be free of dust, dirt, grease, and fungus.

a. Remove dust and loose dirt with a clean soft cloth.

***Warning:* Cleaning Compound (Federal stock No. 7930–395–9542) is flammable and its fumes are toxic. Provide adequate ventilation. *Do not* use near a flame.**

b. Remove grease, fungus, and ground-in dirt from the cases; use a cloth dampened (not wet) with cleaning compound.

c. Remove dust or dirt from connectors with a brush.

d. Clean the front panel and control knobs; use a soft clean cloth. If dirt is difficult to remove, dampen the cloth with water; mild soap may be used for more effective cleaning.

Page 12. Make the following changes.

Section II. Delete the heading and substitute: ORGANIZATIONAL PREVENTIVE MAINTENANCE.

Add paragraph 19.1 below the section heading.

19.1. Scope of Organizational Maintenance

Second echelon maintenance of Signal Generators SG–299/U, SG–299A/U, SG–299B/U, and SG–299C/U includes:

a. Monthly preventive maintenance checks and services (par. 24).

b. Lubrication (par. 23).

Delete paragraph 21 and substitute—

21. Preventive Maintenance

a. Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdowns, and assure maximum operational capability. Preventive maintenance is the responsibility of all echelons concerned with the equipment and includes the inspection, testing, and repair or replacement of parts, subassemblies, or units that inspection and tests indicate would probably fail before the next scheduled periodic service. Preventive maintenance checks and services of Signal Generators SG–299/U, SG–299A/U, SG–299B/U, and SG–299C/U at the second echelon level are made at monthly intervals unless otherwise directed by the commanding officer. The preventive maintenance checks and services should be scheduled concurrently with the periodic service schedule of the carrying vehicle for all vehicular installations.

b. Maintenance forms and records to be used and maintained on this equipment are specified in TM 38–750.

Page 13. Delete figure 6.

Page 14. Delete figure 7.

Page 15. Delete figure 8.

Page 16. Make the following changes:

Delete paragraph 22 and substitute:

22. Monthly Maintenance

Perform the maintenance functions indicated in the monthly preventive maintenance checks and services chart (par. 24) once each month. A month is defined as approximately 30 calendar days of 8-hour-per-day operation. If the equipment is operated 16 hours a day, the monthly preventive maintenance checks and services should be performed at 15-day intervals. Adjustment of the maintenance interval must be made to compensate for any unusual operating conditions. Equipment maintained in a standby (ready for immediate operation) condition must have monthly preventive maintenance checks and services. Equipment in limited storage (requires service before operation) does not require monthly preventive maintenance.

Paragraph 23 (page 1 of C 2), heading. Delete the heading and substitute: Lubrication (Signal Generators SG–299/U, SG–299B U, and SG–299C/U Only).

Delete section III designation and heading.

Delete paragraphs 24 and 25 and substitute—

24. Monthly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Completeness	See that equipment is complete (appx III)	Appx III.
2	Publications	See that all publications are complete, serviceable, and current.	DA Pam 310-4.
3	Modifications	Check DA Pam 310-4 to determine if new applicable MWO's have been published. All URGENT MWO's must be applied immediately. All ROUTINE MWO's must be scheduled.	TM 38-750 and DA Pam 310-4.
4	Exterior cleaning	Remove dirt and moisture from exposed surfaces of housing and control panel.	Par. 17.4.
5	Knobs, dials, and connectors	Check knobs, dials, and connectors for excessive looseness.	
6	Handle	Hand-check for looseness of the handle.	
7	Cord	Inspect power cord for cuts, cracks, strain, fraying, or deterioration.	
8	Preservation	Check all surfaces for evidence of fungus. Remove rust and corrosion, and spot-paint bare spots.	Par. 25.
9	Pluckout items	Inspect the seating of pluckout items. Check for wrong, bent, or broken parts.	
10	Lubrication	Lubricate the fan motor	Par. 23 and Fig. 9.
11	Air filter	Clean or replace the air filter.	
12	Resistors and capacitors	Inspect the resistors and capacitors for cracks, blistering, or other detrimental defects.	
13	Fuses	See that all operating fuses are the correct value	Par. 19.
14	Spare parts	Check all spare parts (operator and organizational) for general condition and method of storage. There should be no evidence of overstock, and all shortages must be on valid requisitions.	Appx III.
15	Controls	While making the operating check (item 17), observe that the mechanical action of each knob, dial, and switch is smooth and free of external or internal binding.	
16	Pilot	During operation (item 17), check for burned-out pilot or indicating lamps.	Par. 19.
17	Operation	Operate the equipment according to paragraph 26	Par. 26.

25. Cleaning and Touchup Painting Instructions

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TM 9-213.

Page 56. Make the following changes.

Figure 41.2 (page 6 of C 2).

Add the following note below note 2.

3. SIGNAL GENERATOR SG-299C/U IS IDENTICAL WITH SIGNAL GENERATOR SG-299B/U EXCEPT FOR THE ADDITION OF A DUAL .1-μF, 250-V, 5-AMP, RF FEEDTHROUGH CAPACITOR ADDED AS ILLUSTRATED IN FIGURE 41.3.

Delete the caption and substitute:

Figure 41.2. Signal Generators SG-299B/U and SG-299C/U power supply, schematic diagram.

Add figure 41.3 after figure 41.2.

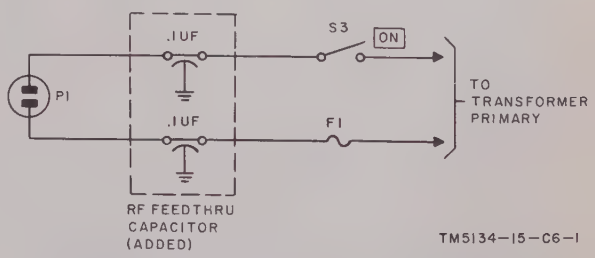

Figure 41.3. Signal Generator SG-299C/U, added capacitors.

Page 57. Make the following changes:

Appendix I (page 1 of C 4). Delete and substitute—

APPENDIX I
REFERENCES

Following is a list of applicable publications available to the operator and repairman of Signal Generators SG–299/U, SG–299A/U, SG–299B/U and SG–299C/U.

DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TM 9–213	Painting Instructions for Field Use.
TM 11–5057	Frequency Meter AN/USM–26.
TM 11–6625–258–20P	Organizational Maintenance Repair Parts and Special Tool Lists: Signal Generators SG–299/U, SG–299A/U, and SG–299B/U.
TM 11–6625–258–20P	Field (Fourth Echelon) and Depot Maintenance Repair Parts and Special Tool Lists: Signal Generators SG–299/U, SG–299A/U, and SG–299B/U.
TM 11–6625–261–12	Operator's and Organizational Maintenance Manual: Audio Oscillators TS–382A/U, TS–382B/U, TS–382D/U, TS–382E/U, and TS–382F/U.
TM 11–6625–274–12	Operator's and Organizational Maintenance Manual: Test Sets, Electron Tube TV–7/U, TV–7A/U, TV–7B/U, and TV–7D/U.
TM 11–6625–316–12	Operator and Organizational Maintenance Manual: Test Sets, Electron Tube Tube TV–2/U, TV–2A/U, TV–2B/U, and TV–2C/U.
TM 11–6625–320–12	Operator's and Organizational Maintenance Manual: Voltmeter, Meter ME–30A/U and Voltmeters, Electronic ME–30B/U and ME–30C/U.
TM 38–750	The Army Equipment Record System and Procedures.

(As changed by C 5, 24 Sept 62). Appendix II (page 2 of C 4).
Delete paragraph 2.
(As changed by C 5, 24 Sept 1962). Appendix III (page 5 of C 4). Delete and substitute:

APPENDIX III
BASIC ISSUE ITEMS LIST
Section I. INTRODUCTION

1. General

a. This appendix lists items supplied for initial operation and for running spares. The list includes tools, parts, and material issued as part of the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment tables and other documents that are a basis for requisitioning.

b. Columns are as follows:

(1) *Source, maintenance, and recoverability code.* Not used.

(2) *Federal stock number.* This column lists the 11-digit Federal stock number.

(3) *Designation by model.* Not used.

(4) *Description.* Nomenclature or the standard item name and brief identifiying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

(5) *Unit of issue.* The unit of issue is each unless otherwise indicated and is the supply term by which the individual item is counted for procurement, storage, requisitioning, allowances, and issue purposes.

(6) *Expendability.* Nonexpendable items are indicated by NX. Expendable items are not annotated.

(7) *Quantity authorized.* Under "Items Comprising an Operable Equipment", the column lists the quantity of items supplied for the initial operation of the equipment. Under "Running Spare Items", the quantities listed are those issued initially with the equipment as spare parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment.

(8) *Illustrations.* Tubes, fuses, and lamp are illustrated in figure 43.

2. Other Service Stock Numbers

Other service items listed herein are authorized in accordance with AR 700–51.

(1) SOURCE MAINTENANCE AND RECOVERABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPENDABILITY	(7) QUANTITY AUTHORIZED	(8) ILLUSTRATIONS FIGURE NO	(9) ILLUSTRATIONS ITEM NO
	6625-624-3516		SIGNAL GENERATOR SG-299/U, SG-299A,B,C/U 1 CPS to 1 mc; 6 bands; ampl continuously var; high impedance 0 to 55v min, low impedance 0-7v peak, to peak; output impedance 75 ohm low, 600 ohm high; 115/230v ±10%; 50-60 cps, 1 ph oper; sync input trigger ckt, 60 db attenuation var in 20 db steps on low output only; bench mtd; steel case 9-3/4 in wd x 13-7/8 in h x 13-3/8 in d					
			ITEMS COMPRISING AN OPERABLE EQUIPMENT					
			SIGNAL GENERATOR SG-299/U, SG-299A/U, SG-299B/U, & SG-299C/U (BASIC COMPONENT)		XX	1		
	Ord thru AGC		TECHNICAL MANUAL TM 11-5134-15			2		
			RUNNING SPARE ITEMS					
	5960-642-8341		ELECTRON TUBE: JAN type 5U4GB			1		
	5960-188-3602		ELECTRON TUBE: JAN type 6BH6			1		
	5960-262-3781		ELECTRON TUBE: JAN type 6BQ7A			1		
	5960-615-0243		ELECTRON TUBE: JAN type 6CL6			3		
	5960-557-6780		ELECTRON TUBE: JAN type 6C4WA			1		
	5960-262-0286		ELECTRON TUBE: JAN type 5651WA			1		
	5960-262-0185		ELECTRON TUBE: JAN type 5726/6AL5W			1		
	5960-543-1001		ELECTRON TUBE: JAN type 6080WA			1		
	5920-655-3113		FUSE, CARTRIDGE: 2.5 amp, 125v; glass; 1-1/4 in lg x 1/4 in dia; Littlefuse type 3AG			5		
	6240-155-8706		LAMP, INCANDESCENT LM-52: pilot lamp, 6-8v, 0.15 amp; miniature bayonet base; clear white bulb; 1-1/8 in h o/a			1		

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

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DASA (6)
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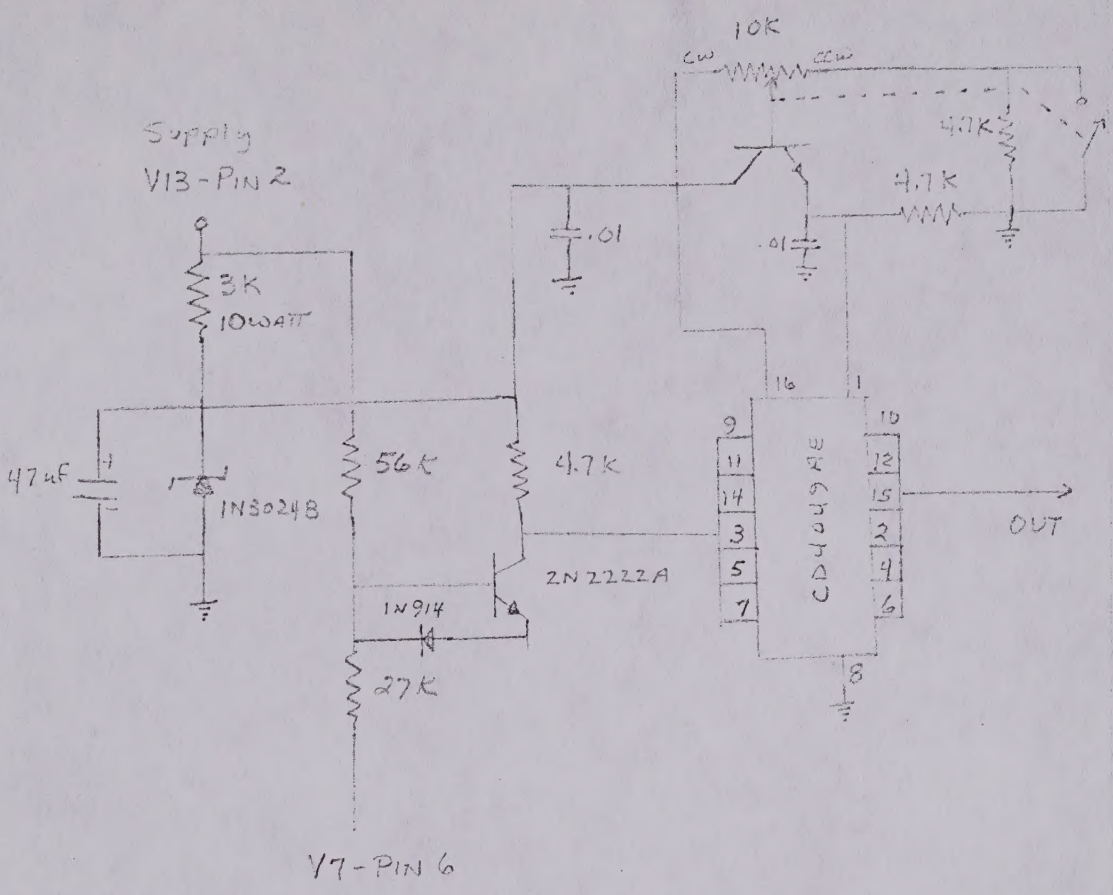
USA CD Agcy (1)
USCONARC (5)
USAMC (5)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (3)
OS Base Comd (2)
LOGCOMD (2)
USAECOM (5)
USAMICOM (3)
USASCC (4)
MDW (1)
Armies (2)
Corps (2)
USATC AD (2)
USATC Engr (2)
USATC Inf (2)
USATC Armor (2)
Instl (2) except
Ft Monmouth (65)
Svc College (2)
Br Svc Sch (2)
GENDEP (OS) (2)
Sig Dep (OS) (12)
Sig Sec, GENDEP (OS) (5)
Army Dep (2) except
Ft Worth (8)
Lexington (12)
Sacramento (28)
Tobyhanna (12)
USA Elct RD Actv, White Sands (13)
USA Elct RD Actv, Ft Huachuca (2)
USA Trans Tml Comd (1)
Army Tml (1)
POE (1)
USAOSA (1)
AMS (1)
WRAMC (1)
AFIP (1)
Army Pic Cen (2)
USA Mbl Spt Cen (1)
USA Elct Mat Agcy (12)
Chicago Proc Dist (1)
USARCARIB Sig Agcy (1)
Sig Fld Maint Shop (3)
USA Corps (3)
DCA (1)
DLSC (1)
Units org under fol TOE:
(2 copies UNOINDC)

11–7	11–155
11–16	11–157
11–55	11–500 (AA–AC) (4)
11–56	11–557
11–57	11–587
11–97	11–592
11–98	11–597
11–117	17

NG: State AG (3); units—same as active Army except allowance is one (1) copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

U. S. GOVERNMENT PRINTING OFFICE: 1963—700502

817–966



PARTS

1	27K	½w
1	56K	½w
1	2.7K	10w
3	4.7K	¼w
1	10K POT W SPST SWITCH on full CCW	
1	CD4049AE	
1	15V 1w Zenner	
2	2N2222A	
2	.01 mf	
1	.47 mf 20v (TANT)	